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computing today

JULY 1982

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ingenious ...but lonely!

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All material should be typed. Any programs submitted must be listed (cassette tapes and discs will not be accepted) and should be accompanied by sufficient documentation to enable their implementation. Please enclose an SAE if you want your manuscript returned, all submissions will be acknowledged. Any published work will be paid for.

All work for consideration should be sent to the Editor at our Charing Cross Road address.

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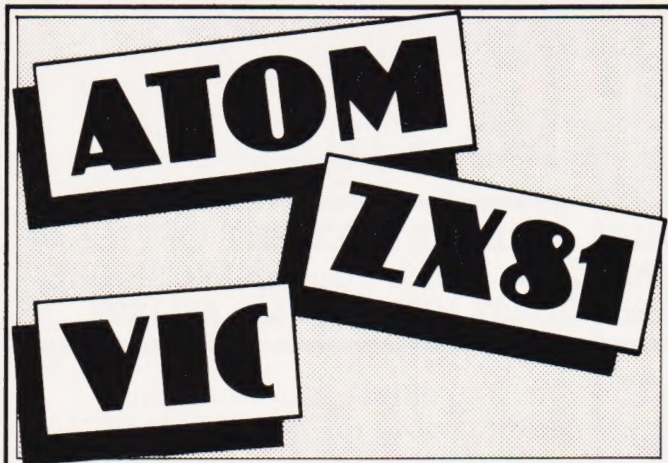
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The TI-99/4A is a sophisticated computer designed not only for the beginner with its ease of operation, but also for the professional with its vast computing power through a 16 bit microprocessor. And it simply plugs into an ordinary household TV set.



With its high resolution graphics with 32 characters over 24 lines in 16 colours (256 x 192 dots), 3 tones in five octaves plus noise, and BASIC as standard equipment and options such as other programming languages—UCSD-PASCAL, TI-LOGO and ASSEMBLER—and speech synthesis, you'll find that the TI 99/4A more than compares with the competition. Especially when the starting price is £340 or less. When you want to solve problems there are over 600 software programs available worldwide—including more than 40 on easy-to-use Solid State Software® Modules.

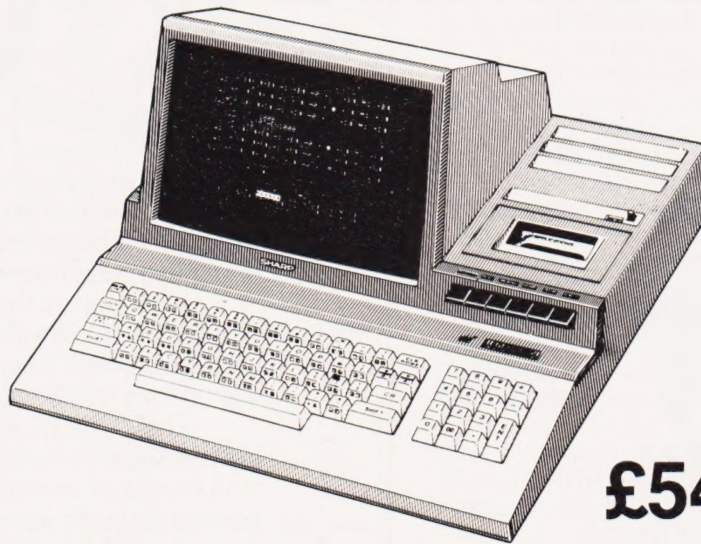
After all, from the inventors of the microprocessor, integrated circuit and microcomputer, it's only natural to expect high technology at a realistic price.



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The new Sharp MZ-80A has many features of the older MZ-80K, with the ability to run 80K software, plus a typewriter style keyboard and numeric keypad. The System has a unique scrolling display, 48K RAM, integral display and cassette and is supplied with Basic and Multi Language options

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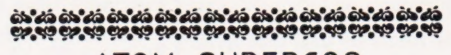
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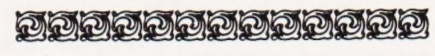
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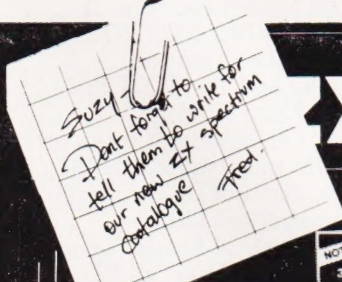
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ZX81 ROM EXPOSED!



Dr. Ian Logan, winner of the 1981 Rosetta Stone Award has written three essential books for those who really want to understand the full working of the SINCLAIR ZX81!

Understanding Your ZX81 ROM

In this book Dr. Logan gives a complete overview of Z80 machine language using the ZX81 monitor program as an example. Dr. Logan explains the structure of the ZX81 ROM, its peculiarities, and how you can use the ZX81 ROM routines for your own purposes. PLUS a special section which shows how you can squeeze more power into your ZX81 by using machine language and machine language subroutines. Complete with example programs, reference tables, etc.

ZX81 ROM Disassembly Part A

This book is for the programmer that needs complete answers about the ZX81. Dr. Logan has examined all routines in the ROM and here he comments on each one. It covers all ROM locations from 0000H to 0F54H, and includes all functions except for the routines used in the floating point calculator.

ZX81 ROM Disassembly Part B

In this the companion volume to Part A Dr. Logan covers locations 0F55H to 1DFFH and includes all routines used in the ZX81 floating point calculator. Co-authored by Dr. Frank O'Hara.

OTHER TITLES AVAILABLE

- ★ **Machine Language Programming Made Simple for the Sinclair**
- ★ **Not Only 30 Programs for the Sinclair ZX81: 1K -**
- ★ **Complete Sinclair ZX81 Basic Course** is a 240 page in-depth comprehensive for complete beginners and experienced programmers. Over 100 programs and examples illustrate the use and possibilities of the Sinclair ZX81.
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BUG BYTES

Ever had one of those days when you're wandering around your favourite valley, slaying monsters and finding the odd bit of treasure, when suddenly, you've either bounced off water, the stairs have disappeared or the screen's scrolled!

Well, as we here at CT get into Apology Mode, the corrections to the Valley program (published in April's Computing Today) are as follows:

```
2890 PRINT DS;"AN AMULET STONE..."
```

and

```
12080 PRINT "[HOM]";D2$;R2$;"[2 CR]
[REV][2^SPC][OFF]"
12090 PRINT R2$;"[CR][REV][5^SPC]
[OFF]"
12100 PRINT R2$;"[REV][2^SPC][OFF]
[2 SPC][REV][2^SPC][OFF]"
12110 PRINT R2$;"[REV][2^SPC][^&]
[OFF][SPC][REV][3^SPC][OFF]"
12120 PRINT R2$;"[CR][REV][4^SPC]
[OFF][CR][REV][2^SPC][OFF]"
12130 PRINT R2$;"[3 CR][REV][2^SPC]
[OFF]"
12140 PRINT R2$;"[4 CR][REV][^SPC]
[OFF]"
```

Very sorry... it was an awfully long program though. Are we forgiven?

Also, we appear to have got a bit (subtle ASCII joke!) confused in the Aftermath article (see June issue). The caption to the picture of Ian McNaught-Davis should have read COI and *not* DOI.

LIVE IN COLOUR

How closely were you watching the recent Computer Programme on the BBC? Did you notice the display they used? No... well, it was the Low Complexity Colour Display developed by Microvitec.



Available as a desktop 14" screen metal cabinet model, the LCCD — in standard resolution format — offers up to 80 column capability. Other microcomputers with which the LCCD is already compatible include the Apple II

and III and machines manufactured by Research Machines, Sharp, Cromemco, Data Applications and Fujitsu.

The 14" metal cabinet LCCD is priced at £279 although Microvitec offer a range of other LCCDs with different specifications (and lower prices!). For further details contact Microvitec Ltd, Futures Way, Bolling Road, Bradford or 'phone them on 0274-390011.

COOL TO THE CORE ▼

If you think your Apple II system is pretty hot stuff then maybe you need to consider one of the functions of the POWER CORE. Combining two functions in one package, the POWER CORE acts as both a cooling system and a switching and filtering system.

As a cooling system, the POWER CORE reduces the internal temperature of the Apple from 47°C to 23°C allowing the computer to work without any fear of a crash due to overheating.

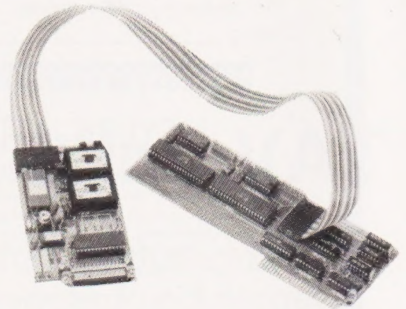
The front panel of the package contains four illuminated switches controlling the switching and filtering operation. These switches control the power supply, the filtered output, the fan and a switch which can be used for a printer or other peripheral devices.

The price of the POWER CORE unit is £149.50 inclusive of VAT and p&p and is available from Avitek, PO Box 14, Twyford, Reading, Berks RG10 0LL. For further details you could always ring 0734-343020.

PICK A CARD

A couple of interface cards have been introduced for the Apple II micro.

The U-A/D is a complete interfacing system in one, offering an eight channel high speed 12-bit A/D convertor, 16 digital I/O lines and timer functions. Complete documentation and example programs are included in the package.

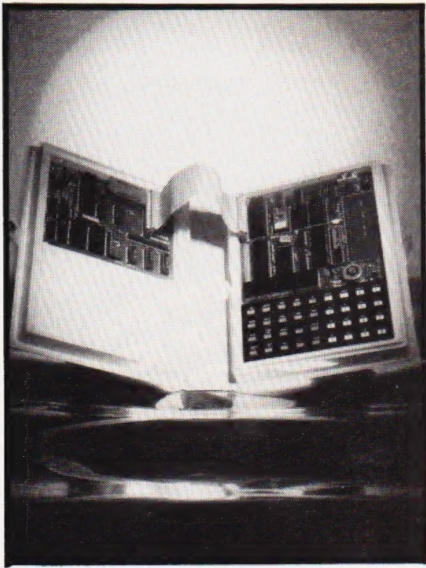


The other card is designated the U-DT and provides 32 digital I/O lines and timer functions. It also incorporates two 6522 VIA chips for versatile operation.

The U-A/D and the U-DT are priced at £250 and £105 respectively. For details of these or the other eight interface cards they manufacture, contact Dr Unsworth at U-Microcomputers Ltd, Winstanley Industrial Estate, Long Lane, Warrington, Cheshire WA2 8PR or telephone him on 0925-54117.



CONSUMER NEWS



ADDING TO THE PROF ▲

If you're an avid reader of CT (and we hope you are), you'll probably remember a fair amount of discussion about the Micro-Professor. At that time a number of add-on options were promised to be available soon. Well, they have arrived!

First up is a speech synthesis board (SSB-MPF), based on the Texas Instruments' voice synthesis processor TMS5200. A TMS2532 memory chip is built into the SSB-MPF for storing a utility program and speech data and there is room for two additional TMS2532 chips allowing up to 150 words to be stored. Also included in the system is a 32K TMS6125 voice synthesis socket for future expansion of the device. The price of this unit, complete with time clock program, mains adaptor, ribbon cable and manual, is £64.95 + VAT.

The other extra is an EPROM programmer board, designated EPB-MPF, which allows the programming capability to read data from EPROM to RAM buffer, to verify EPROM with RAM buffer, to display or modify data on RAM buffer, to re-start the EPB-MPF to its initial state, to write data from the RAM buffer to EPROM, to store data in RAM buffer onto cassette tape and to load data with a cassette recorder. Packaged with keyboard overlay, ribbon cable connectors, power supply and manual, the EPB-MPF is priced at £74.95 + VAT.

For further information get in touch with Flight Electronics Ltd, Flight House, Quayside Road, Bitterne Manor, Southampton, Hampshire SO2 4AD or 'phone them on 0703-34003.

NATIONWIDE

The electronic and leisure products chain, Dixons, have decided to market the Commodore VIC 20 colour computer in 250 of their stores throughout the country.

Predicting that by the end of 1985 over one million households will have a home computer, Dixons are hoping they can install a fair share of these by offering the VIC 20 at £199.99.

Dixons have invested over £150,000 into their national press publicity campaign as well as time computer marketing. Still, they'll probably need all the help they can get once the ZX Spectrum and Acorn's Electron start gathering sales!

THE KEY TO SUCCESS

You might have missed this product at the last ZX Microfair (what with the crowds and all) so here's a brief run-down on a new keyboard designed to fit onto the ZX81.

Without the hassle of trailing wires and internal modifications, the keyboard is fitted by peeling off the touch-sensitive keyboard and replacing it with the new one (connectors being made via ribbon cable). The keys are mounted on a PCB finished in matt black and all have a positive 'click' when pressed.

The keyboard is sold as a kit by mail order for £22.50 complete with a set of scaled-down legends to fit onto the keys. To obtain one of these keyboards, send off to Kempston Electronics, 60 Adamson Court, Hillgrounds Road, Kempston, Bedford MK42 8QZ.

BBC NORWICH

No, this isn't about a new TV channel, it's just to tell you about the Norwich & District BBC Microcomputer User Group.

Membership is £2 for 1982, although if you are an old age pensioner or student, membership will only cost £1. For more details, contact Paul Beverley, Room B12a, Norwich City College of Further & Higher Education, Ipswich Road, Norwich, Norfolk NR2 2LJ or telephone him on 0603-60011 extension 233.

TEACHER'S PET ▼

Using the NASCOM 2 microcomputer in an optimised configuration, the MICRO-ED is an ideal system for use in the classroom environment.

Intended for use as a cassette-based system, the MICRO-ED can also be used in the NAS NET classroom network in DOS mode. Complete with 8K of user RAM, the system has a 57-key solid state keyboard built into the black structural foam plastic case it is housed in.

The MICRO-ED is priced at £399 + VAT but, if you are a full time educational establishment, you can get a very generous discount depending on the quantity you order (discounts vary between 5% and, for orders of 50 units and over, 17.5%).

For more details of the MICRO-ED and the special education offer, get in touch with Lucas Logic Ltd, Nascom Division, Welton Road, Wedgnoek Industrial Estate, Warwick CV34 5QZ.



New ZX81 Software from Sinclair.

A whole new range of software for the Sinclair ZX81 Personal Computer is now available – direct from Sinclair. Produced by ICL and Psion, these really excellent cassettes cover games, education, and business/household management.

Some of the more elaborate programs can only be run on a ZX81 augmented by the ZX 16K RAM pack. (The description of each cassette makes it clear what hardware is required.) The RAM pack provides 16-times more memory in one complete module, and simply plugs into the rear of a ZX81. And the price has just been dramatically reduced to only £29.95.

The Sinclair ZX Printer offer full alphanumeric and highly-sophisticated graphics. A special feature is COPY which prints out exactly what is on the whole TV screen without the need for further instructions. So now you can print out your results for a permanent record. The ZX Printer plugs into the rear of your ZX81, and you can connect a RAM pack as well.

Games

Cassette G1: Super Programs 1 (ICL)

Hardware required – ZX81.

Price – £4.95.

Programs – Invasion from Jupiter. Skittles. Magic Square. Doodle. Kim. Liquid Capacity.

Description – Five games programs plus easy conversion between pints/gallons and litres.

Cassette G2: Super Programs 2 (ICL)

Hardware required – ZX81.

Price – £4.95.

Programs – Rings around Saturn. Secret Code. Mindboggling. Silhouette. Memory Test. Metric conversion.

Description – Five games plus easy conversion between inches/feet/yards and centimetres/metres.

Cassette G3: Super Programs 3 (ICL)

Hardware required – ZX81.

Price – £4.95.

Programs – Train Race. Challenge. Secret Message. Mind that Meteor. Character Doodle. Currency Conversion.

Description – Five games plus currency conversion at will – for example, dollars to pounds.

Cassette G4: Super Programs 4 (ICL)

Hardware required – ZX81.

Price – £4.95.

Programs – Down Under. Submarines. Doodling with Graphics. The Invisible Invader. Reaction. Petrol.

Description – Five games plus easy conversion between miles per gallon and European fuel consumption figures.

Cassette G5: Super Programs 5 (ICL)

Hardware required – ZX81 + 16K RAM.

Price – £4.95.

Programs – Martian Knock Out. Graffiti. Find the Mate. Labyrinth. Drop a Brick. Continental.

Description – Five games plus easy conversion between English and continental dress sizes.

Cassette G6: Super Programs 6 (ICL)

Hardware required – ZX81 + 16K RAM.

Price – £4.95.

Programs – Galactic Invasion, Journey into Danger. Create. Nine Hole Golf. Solitaire. Daylight Robbery.

Description – Six games making full use of the ZX81's moving graphics capability.

Cassette G7: Super Programs 7 (ICL)

Hardware required – ZX81.

Price – £4.95.

Programs – Racetrack. Chase. NIM. Tower of Hanoi. Docking the Spaceship. Golf.

Description – Six games including the fascinating Tower of Hanoi problem.

Cassette G8: Super Programs 8 (ICL)

Hardware required – ZX81 + 16K RAM.

Price – £4.95.

Programs – Star Trail (plus blank tape on side 2).

Description – Can you, as Captain Church of the UK spaceship Endeavour, rid the galaxy of the Klingon menace?

Cassette G9: Biorhythms (ICL)

Hardware required – ZX81 + 16K RAM.

Price – £6.95.

Programs – What are Biorhythms? Your Biohythms.

Description – When will you be at your peak (and trough) physically, emotionally, and intellectually?

Cassette G10: Backgammon (Psion)

Hardware required – ZX81 + 16K RAM.

Price – £5.95.

Programs – Backgammon. Dice.

Description – A great program, using fast and efficient machine code, with graphics board, rolling dice, and doubling dice. The dice program can be used for any dice game.

Cassette G11: Chess (Psion)

Hardware required – ZX81 + 16K RAM.

Price – £6.95.

Programs – Chess, Chess Clock.

Description – Fast, efficient machine code, a graphic display of the board and pieces, plus six levels of ability, combine to make this one of the best chess programs available. The Chess Clock program can be used at any time.



Cassette G12: Fantasy Games (Psion)

Hardware required – ZX81 (or ZX80 with 8K BASIC ROM) + 16K RAM.

Price – £4.75.

Programs – Perilous Swamp. Sorcerer's Island.

Description – Perilous Swamp: rescue a beautiful princess from the evil wizard Sorcerer's Island: you're marooned. To escape, you'll probably need the help of the Grand Sorcerer.

Cassette G13: Space Raiders and Bomber (Psion)

Hardware required – ZX81 + 16K RAM.

Price – £3.95.

Programs – Space Raiders. Bomber. Description – Space Raiders is the ZX81 version of the popular pub game. Bomber: destroy a city before you hit a sky-scraper.

Cassette G14: Flight Simulation (Psion)

Hardware required – ZX81 + 16K RAM.

Price – £5.95.

Program – Flight Simulation (plus blank tape on side 2).

Description – Simulates a highly manoeuvrable light aircraft with full controls, instrumentation, a view through the cockpit window, and navigational aids. Happy landings!

Education

Cassette E1: Fun to Learn series – English Literature 1 (ICL)

Hardware required – ZX81 + 16K RAM.

Price – £6.95.

Programs – Novelists. Authors. Description – Who wrote 'Robinson Crusoe'? Which novelist do you associate with Father Brown?

Cassette E2: Fun to Learn series – English Literature 2 (ICL)

Hardware required – ZX81 + 16K RAM.

Price – £6.95.

Programs – Poets, Playwrights. Modern Authors.

Description – Who wrote 'Song of the Shirt'? Which playwright also played cricket for England?



Cassette E3: Fun to Learn series - Geography 1 (ICL)

Hardware required - ZX81 + 16K RAM.

Price - £6.95.

Programs - Towns in England and Wales. Countries and Capitals of Europe. Description - The computer shows you a map and a list of towns. You locate the towns correctly. Or the computer challenges you to name a pinpointed location.

Cassette E4: Fun to Learn series - History 1 (ICL)

Hardware required - ZX81 + 16K RAM. Price - £6.95.

Programs - Events in British History. British Monarchs.

Description - From 1066 to 1981, find out when important events occurred. Recognise monarchs in an identity parade.

Cassette E5: Fun to Learn series - Mathematics 1 (ICL)

Hardware required - ZX81 + 16K RAM. Price - £6.95.

Programs - Addition/Subtraction. Multiplication/Division.

Description - Questions and answers on basic mathematics at different levels of difficulty.

Cassette E6: Fun to Learn series - Music 1 (ICL)

Hardware required - ZX81 + 16K RAM. Price - £6.95.

Programs - Composers. Musicians.

Description - Which instrument does James Galway play? Who composed 'Peter Grimes'?

Cassette E7: Fun to Learn series - Inventions 1 (ICL)

Hardware required - ZX81 + 16K RAM. Price - £6.95.

Programs - Inventions before 1850. Inventions since 1850.

Description - Who invented television? What was the 'dangerous Lucifer'?

Cassette E8: Fun to Learn series - Spelling 1 (ICL)

Hardware required - ZX81 + 16K RAM. Price - £6.95.

Programs - Series A1-A15. Series B1-B15. Description - Listen to the word spoken on your tape recorder, then spell it out on your ZX81. 300 words in total suitable for 6-11 year olds.

Business/household

Cassette B1: The Collector's Pack (ICL)

Hardware required - ZX81 + 16K RAM. Price - £9.95.

Program - Collector's Pack, plus blank tape or side 2 for program/data storage. Description - This comprehensive program should allow collectors (of stamps, coins etc.) to hold up to 400 records of up to 6 different items on one cassette. Keep your records up to date and sorted into order.

Cassette B2: The Club Record Controller (ICL)

Hardware required - ZX81 + 16K RAM. Price - £9.95.

Program - Club Record Controller plus blank tape on side 2 for program/data storage.

Description - Enables clubs to hold records of up to 100 members on one cassette. Allows for names, addresses, 'phone numbers plus five lots of additional information - eg type of membership.

Cassette B3: VU-CALC (Psion)

Hardware required - ZX81 + 16K RAM. Price - £7.95.

Program - VU-CALC.

Description - Turns your ZX81 into an immensely powerful analysis chart. VU-CALC constructs, generates and calculates large tables for applications such as financial analysis, budget sheets, and projections. Complete with full instructions.

Cassette B4: VU-FILE (Psion)

Hardware required - ZX81 + 16K RAM. Price - £7.95.

Programs - VU-FILE. Examples.

Description - A general-purpose information storage and retrieval program with emphasis on user-friendliness and visual display. Use it to catalogue your collection, maintain records or club memberships, keep track of your accounts, or as a telephone directory.

How to order

Simply use the FREEPOST order form below and either enclose a cheque or give us your credit card number. Credit card holders can order by phone - simply call Camberley (0276) 66104 or 21282 during office hours. Either way, please allow up to 28 days for delivery, and there's a 14-day money-back option, of course.

sinclair ZX81 SOFTWARE

Sinclair Research Ltd, Stanhope Road, Camberley, Surrey, GU15 3PS. Tel: Camberley (0276) 66104 & 21282.

To: Sinclair Research, FREEPOST, Camberley, Surrey, GU15 3BR. Please send me the items I have indicated below.

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	G1: Super Programs 1	30	£4.95	
	G2: Super Programs 2	31	£4.95	
	G3: Super Programs 3	32	£4.95	
	G4: Super Programs 4	33	£4.95	
	G5: Super Programs 5	34	£4.95	
	G6: Super Programs 6	35	£4.95	
	G7: Super Programs 7	36	£4.95	
	G8: Super Programs 8	37	£4.95	
	G9: Biorhythms	38	£6.95	
	G10: Backgammon	39	£5.95	
	G11: Chess	40	£6.95	
	G12: Fantasy Games	41	£4.75	
	G13: Space Raiders & Bomber	42	£3.95	
	G14: Flight Simulation	43	£5.95	
	E1: English Literature 1	44	£6.95	

Qty	Cassette	Code	Item price	Total
	E2: English Literature 2	45	£6.95	
	E3: Geography 1	46	£6.95	
	E4: History 1	47	£6.95	
	E5: Mathematics 1	48	£6.95	
	E6: Music 1	49	£6.95	
	E7: Inventions 1	50	£6.95	
	E8: Spelling 1	51	£6.95	
	B1: Collector's Pack	52	£9.95	
	B2: Club Record Controller	53	£9.95	
	B3: VU-CALC	54	£7.95	
	B4: VU-FILE	55	£7.95	
	ZX 16K RAM pack	18	£29.95	
	ZX Printer	27	£59.95	
	Post & packing - only if ordering hardware		£2.95	

TOTAL £ _____

I enclose a cheque/postal order to Sinclair Research Ltd for £ _____

Please charge my *Access/Barclaycard/Trustcard no. _____

*Please delete as applicable. _____

Mr/Mrs/Miss _____

Address _____



THE SERIES SERIES ▲

Based on the S-100 hardware configuration and utilising a Z80 chip, Almarc are offering five systems within the SERIES-8 range.

The smallest in the range includes a twin floppy device with a total capacity of 1.6M. However, the remaining four machines in the SERIES-8 range are all multi-user systems using Rodime 3,6,9 and 12M hard discs. In the devices using hard disc storage, the design allows for up to four disc units to be added allowing a maximum storage of up to 48M.

The SERIES-8 is offered with tape cartridge back-up and a complete range of dot matrix and letter quality printers. The software supplied with each system is CP/M and MP/M II.

Price for computer systems, including printer and commercial software, will range from £4,000. For further information contact Almarc Data Systems Ltd, Great Freeman Street, Nottingham NG3 1FR or telephone 0602-52657. And while you're talking to them, why not ask them about the Rodime 21M hard disc drive and their new bubble memory option.

A NEW CONCEPT?

Keen Computers Ltd have launched the Corvus Concept, a 16-bit microcomputer designed to operate both as a stand-alone desk-top computer and as a workstation.

The Concept system features memory sizes of up to 512K and can be attached to up to four Corvus hard disc units allowing a storage capacity of up to 80M. Although the Corvus Concept will operate efficiently as a stand-alone unit, the

design caters for users wishing to create a full Omnet local area network with up to 63 Concepts networked together, each with up to 80M of storage and a wide range of peripherals.

Incorporating two RS232 connections, a clock, two interval timers, a flexible sound generator and speaker and four 50-pin card sockets, the Concept has an efficient operating system, Pascal and FORTRAN compilers and a CP/M emulator.

Keen will be marketing the Concept somewhere around the £3,500-4,000 mark. For further details get in touch with Keen Computers Ltd, 5 Giltspur Street, London EC1 or telephone 01-236 5682.

PRETTY POLY(DOS)

A complete DOS, called PolyDOS, has been designed for the NASCOM 1,2 and 3 microcomputers.

Fully compatible with all existing software written for NAS-SYS 1 or 3, PolyDOS can be installed on any NASCOM with a minimum of 48K RAM and either a GM815 floppy disc system with a Gemini GM809 floppy disc controller card or a Gemini floppy disc system.

Under PolyDOS, the GM815 disc system will support a double sided double density disc giving up to 315K total storage per drive whereas the GM805 system will support only single density format allowing up to 175K per drive. Single density discs are interchangeable between the two systems.

The PolyDOS system includes a 4K disc BASIC extension program,

a disc-based editor and an assembler as well as three utility programs. Supplied as a system disc and two 2708 EPROMs, the complete PolyDOS package costs just £90 + VAT and is available from any MicroValue dealer.

For further information get in touch with Gemini Microcomputers Ltd, Oakfield Corner, Sycamore Road, Amersham, Bucks HP6 5EQ or by telephone on 02403-28321.

MAMA MIA ▼

Comprising a keyboard, mini floppy disc unit and a separate video display, the Olivetti M20 personal computer is a desk-top machine aimed at the scientific as well as the professional user.

The central unit has a storage capacity ranging from 128-224K, although the floppy disc unit has a capacity of 320K which can be doubled by adding a second disc unit. At a later date it is planned to add a Winchester-type hard disc to the system.

The M20 display can be tilted vertically and horizontally and either black & white or colour screens are available. A special feature of the M20 video display is its ability to be divided up into 16 windows for displaying alphanumeric and graphic information simultaneously.

All system functions are controlled by the Professional Computer Operating System and the M20 can be programmed in BASIC 8000.

Available for £2,400, you can find out more about the M20 personal computer from British Olivetti Ltd, Olivetti House, 86-88 Upper Richmond Road, Putney, London SW15 2UR or by phoning 01-785 6666.



BUSINESS NEWS

A COMPUTER A DAY...▶

A British microcomputer, a Z80-based system featuring 64K of RAM, integral dual drives and multiple interfaces, has been launched to appeal to the experienced user in business and education.

Called the Pippen 64 (competition for the Apple, no doubt), the device, complete with CP/M operating system, is being offered to systems houses and computer distributors as the core of a sales package to which they can add further software.

The monitor, disc drives and PSU are all mounted in a self-contained cabinet; the full ASCII keyboard comes as a separate unit. The dual disc drives use double sided double density 5¼" floppy discs and for those requiring additional storage, the facility exists to add another floppy or a Winchester hard disc. An RS232 and Centronics printer interface are standard.

The price of the Pippen 64 is £1,950. Further information can be obtained from Compact Business Machines, Unit 5, Victoria Road, Portslade, Brighton, E Sussex BN4 1XQ or by telephoning 0273-420195.

OKI-DOKEY

Introduced to the market last year, the OKI IF800 micro has been improved for 1982. The standard specification now includes a Centronics standard interface, floppy disc drives with storage capacity of up to 800K and an analogue/digital interface.

The IF800 also contains some new options including the facility to use a digitiser and graph plotter and a light pen as well as connection for a Winchester disc drive allowing the basic system to be expanded up to 10M.

Due to be marketed via computer dealers and shops, the IF800 is priced at £4,300 + VAT. Enquiries should be directed to LSI Computers Ltd, Sherwood Place, St Johns, Woking, Surrey GU21 1SX or by telephone on 04862-23411.

COMPUTER CATALOGUE

Everything you always wanted for your computer but were afraid to order? Now's your chance... take a long look at the Willis Computer Supplies catalogue — it's got everything!



Complete with pricing and ordering information, the catalogue includes comprehensive sections on data storage media, all office and computer room furniture and a separate section devoted entirely to cleaning products.

Copies of the catalogue are available from Willis Computer Supplies Ltd, PO Box 10, South Mill Road, Bishop's Stortford, Herts.

MINI TERMINAL ▼

A portable book-size terminal has been launched, ideal for data entry and retrieval around the factory floor, office and retail operations.

Measuring just 2" by 7" by 12", the Transterm One can be used flat on a desk or mounted vertically. Packaged in a rugged casing, the

device includes a 64 character alphanumeric display worked through a typewriter format keyboard.

Communicating in full duplex with a V-24/RS232 serial interface, the Transterm One also has an RS422 or 20mA loop option available. A mode switch can select typewriter emulation, block send, multidrop polled or line monitor code.

Priced at around £350, the designers see the unit being used as a portable console terminal and microprocessor support device. For more information on the Transterm One contact Technical Designs, 2 Albone Way, Biggleswade, Bedfordshire SG18 8PQ. Telephone enquiries can be made on 0767-312470.



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The CRT Controller Handbook	£9.95
The 68000 Microprocessor Handbook	£9.95
16 Bit Microprocessor Handbook	£15.95
4 and 8 Bit Microprocessor Handbook	£15.95

Software Listings:

* Some Common BASIC Programs	£9.85
* Practical BASIC Programs	£10.25
* Practical Programs: Chess, Medbil, Wdproc	£25.00

Business:

* Accounts Payable and Accounts Receivable	£14.85
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PIMS: Personal Information Management System	£6.50
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CP/M Handbook	£12.10
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Z8000 Assembly Language Programming	£14.85

FOR THE Z80, TRS-80, ZX81, 380Z

Z80 Assembly Language Programming	£13.50
Z80 Instruction Handbook (Wadsworth)	£5.00
Programming the Z80 (Zacs)	£11.95
32 BASIC Programs for the TRS-80 (Level II) 16K	£11.10
Introduction to the T-Bug (Guide to TRS-80 Machine Language Monitor)	£7.60
* 30 Programs for the Sinclair ZX80	£6.95
Cambridge Collection for the ZX81	£4.95

CONCERNING LANGUAGE

Beginners Guide for the UCSD PASCAL Systems	£9.50
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FOR THE 6502

(PET, APPLE, ATARI etc.)

Best of Micro. Vol 2	£5.50
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Computes First Book of ATARI	£10.25
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FANTASTIC DISCOUNTS!

We are re-vamping our current list of books and are pleased to be able to offer you a 25% DISCOUNT On all titles marked with a star *. All orders must be accompanied by cheque, cash or postal orders. Normal p & p (see order info. below). Payment will be returned if the book you want is no longer in stock.

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* 6800 Software Gourmet Guide and Cookbook	£7.85
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d) A Tiny PASCAL Compiler	£13.00
e) An APL Interpreter in PASCAL	£13.00
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ORDER INFORMATION

MAGAZINES: Magazine back issues that are not currently in stock are often difficult to obtain. For unavailable and out of print back issues there is a photocopying service at 15p per page plus 30p p.p plus VAT.

BOOKS: Most books are published in the USA and stocked in Britain by Microcomputer Products International Ltd. We aim to keep all of these books in stock and as a result of this, most prepaid orders are despatched by return of post. Please add £1.00 towards postage plus 15p VAT for EACH book purchased. If purchasing more than 3 books at any one time, please add 25p plus 4p VAT for each extra title (over the 3).

PAYMENT: All payment must be in sterling and drawn against a UK Bank. Send cash, cheques, postal orders. IMC. Access or Barclaycard No. to: Microcomputer Products International Ltd., Room CT. 8-9 Cambridge Road, Barking, Essex IG11 8NT Telephone: 01-591 6511. Telex: 892395.

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SOFTWARES

GETTING IN ON THE ACT

A totally integrated small business package has been designed for single user floppy disc based systems. There are seven programs in the ISBS-F range of software and all can be seen demonstrated on an ACT Sirius micro at Graffcom's showroom in Holland Park.

The package contains programs for stock control, order entry and invoicing, names and addresses, payroll, company purchases, company sales and general accounting. Each program can be used stand-alone or can be built into an integrated system to user specification.

Supplied with comprehensive reference manuals, the total package is priced at £2,100. For more information contact Graffcom Systems Ltd, 102 Portland Road, Holland Park, London W11 4LX. Telephone enquiries can be made on 01-727 5561.

THE TESTUBE TAPE

A cassette is now available to help you in your quest to pass your GCE/CSE Chemistry exams.

Written for the ZX81 with 16K RAM pack, the cassette includes four programs designed to help students assess their understanding of chemistry; this package is not intended as an introduction to the subject but should correct any misconceptions you may have made.

The programs are based on the assertion/reason questions used by many examining boards; the student will be given pairs of

statements to which an indication of whether they are true or false must be made. Programs can be run either in tutorial mode where explanations for wrong answers are given or in the test mode in which a score is given after all the questions have been answered.

For further information, including details of prices, contact CALPAC Computer Software, 108 Hermitage Wood Crescent, St Johns, Woking, Surrey GU21 1UF.

A MODEL BUSINESS? ▼

Business Modeller is a software package that will address a matrix of 10,000 coordinates allowing a wide range of simple commands to help laying out the worksheet and enter information. It also has numerous built-in functions to facilitate data manipulation and enables the user to create new functions relevant to individual requirement.

Designed for the general manager with no interest in computing, Business Modeller can display a continually updated status check on variable program data or provide help directly related to the operation being performed.

Complete with two program discs, a comprehensive manual, a keyboard mask to identify user defined functions and a pocket-sized card summarizing all the most useful instructions, Business Modeller costs £350.

For further information get in touch with Software Unlimited, Chobham Road, Sunningdale, Berks SL5 0DS or 'phone 0990-21573.



CARD TRICK ▲

Caxton, that somewhat enigmatic software publishing company, have done it again. After the successful launch of their Optimiser linear programming package they have just launched the Cardbox.

Written for CP/M based machines, and demonstrated at the launch on Osborne and Advantage micros, it could totally replace the 2500 index cards I've been lumbered with over the last three years.

The product is, to put it simply, totally idiot proof. You can even turn the power off halfway through a job and when you restore the system it will report that you may have lost data and tell you what actions you should take to minimise the loss. That's what I call impressive!

Information stored in the 'electronic' file cards can be formatted in any way you wish and information can be retrieved by a series of data base style interrogations. The program is fully menu driven and many of the commands are compatible with the other popular CP/M based program — Wordstar.

Cardbox is currently being offered at the somewhat conservative price of £155 plus VAT. You can obtain more information directly from Caxton at 10-14 Bedford Street, Covent Garden, London WC2E 9HE or ring on 01-379 6502. Henry Budget



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Roger Munford

For those of you who want to become more familiar with computing yet can't seem to fit it into your busy lives, here's a suggestion — why not mix learning with leisure and take a computing holiday? Although the concept of the 'computer holiday camp' has only recently been imported from America, there is already a wide choice of holidays available.

Back To School

The London Computer Summer School, based at Middlesex Polytechnic, are offering five — and seven-day residential or day courses. The courses are aimed at elementary, intermediate and advanced levels to cater for people with little or no previous experience of computing to those already capable with micros who wish to extend their knowledge.

All tuition and practice is given in BASIC as with all of the other holidays. The machine utilised by the School is the VIC-20, with one between every two students. The classes contain no more than 16 students, each taught by one of the School's 25 qualified lecturers with trained assistants available to help with problems. Optional practical workshops and a variety of computers and peripherals are available for further demonstration, comparison and practice.

Although the courses are available to anyone from the age of 13, the younger classes are taught separately to the adults. The School also offers special, less intensive, short courses for children between the ages of 10-12 on a non-residential basis.

The School's programme also includes a range of holiday recreational and sporting facilities.

Computer Campus

For those of you who don't like the idea of a holiday near London, how about a week down at Southampton University? Offering tuition to beginners, enthusiasts, business and professional people, the University's Computer Holiday Camp provides participants with access to a variety of popular micros allowing them to either sit and experiment or take advantage of the workshops and demonstrations available. The machines can be used 24 hours a day!

On particular weeks of this course, specifically designed programs can be provided for common interest groups such as GPs,

Policepersons, journalists and secretaries. There is also an experienced Management Consultant available for advice and help, particularly to those running small businesses and the self-employed.

Each student will have his or her own study/bedroom on campus and will be free to enjoy all the sporting and recreational facilities.

Join The Jet Set

The Computer Holiday Week at Bude Holiday Park in North Cornwall from 25th September to 1st October is for computer enthusiasts to share the company of others of a like mind and learn from their experiences.

Your week, organised by Concorde Holidays, will be spent in a modern caravan equipped with all modern conveniences including a VDU! In the main complex there will be room for some 40-60 computers to be set up by individuals to show off their skills. There will also be caravans available for manufacturers and software suppliers who will be able to help and discuss problems.

Included in the Park's amenities are a swimming pool, a shop, two bars, a games room and a dance floor.

In The Swim

The last two holidays on offer are mainly aimed at the younger generation. The first is from Dolphin Camps; an organisation with camps in North London at Mill Hill, in South London at Sevenoaks and in a private estate near Carlisle in the Lake District.

Backed by the Education Unit of the Department of Industry, Dolphin's International Technology Camps have also received generous donations from industry. Indeed, Acorn have provided 40 BBC machines for use at the Sevenoaks camp, Apple have supplied 42 systems to the Mill Hill camp and the Lake District camp is in proud possession of 42 TI 99/4As from Texas Instruments. All systems are complete with peripheral and software back-up and the camps' experienced supervisors provide close supervision.

Kids Stuff

Last, but not least, are the camps organised by Beaumont Summer Camps for children mostly aged between 10 and 15.

At each of their camps, based at Cheshire, North London, the Lake District, Windsor and Sevenoaks,

there will be the opportunity to use about 30 microcomputers. Each camp will also have two or three disc-based systems available for more complex teaching and applications.

The children who attend these courses need no previous knowledge of computers and require no special aptitude other than a keen interest in computing. The teachers at the camps are polytechnic lecturers or university students, all with considerable knowledge of computing and an interest in teaching children.

Other activities at the Beaumont camps include fencing, football, windsurfing, shooting, dancing, gymnastics and horse-riding.

Have a nice Summer!

London Computer Summer School,
Mortimer House,
37/41 Mortimer Street,
London W1N 7RJ.
01-886 4292
Courses run from July 10—September 11.
Inclusive residential fee is £195.
Inclusive non-residential fee is £149.50.
Non-residential fee for children aged 10-12
is £115.

Computer Holiday Camps,
Dr Lionel Wardle,
Management and Personnel Services,
37 University Road,
Highfield,
Southampton SO2 1TL.
0703-558621
Courses run from July to September.
Self-catering fee is £115.
Part-board fee is £165.

Concorde Holidays,
25 Fore Street,
Praze-An-Beeble,
Camborne,
Cornwall TR14 0JX.
0209-831274
The Computer Holiday Week will run from
September 25 — October 1.
The price per caravan for six people is
£40-60 + VAT.
For suppliers and manufacturers, caravans
are available at £120 which includes ac-
comodation for the whole week.

Dolphin Camps,
8/10 Parkway,
London NW1 7AA.
01-267 6024
01-267 6926 (24 hours)
Holiday weeks run from July 10 —
August 28.
Price for each week is £70 although there
are some free places available for
deserving children.

Beaumont Summer Camps,
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01-736 3272
Holiday weeks run from July 19 —
September 3.
Price for each week is £30.

NEXT MONTH



TOP HOLE!

Well, almost! Next month sees the start of a major new series on advanced software techniques — the skills of Elegant Programming. If you have worked your way through the First Bytes series or tried all the examples in your micro's manual and are looking for something a little more challenging, then this is the place to look.

The series will introduce and expand many of the fundamental rules vital to good programming. It is not simply enough to have a program that runs, the real challenge is to write it more efficiently and with less chance of 'bombs' or other misfortunes.

If you really want to know how programming should be done then the next issue of Computing Today is a must. If you're happy to carry on writing sloppy, inefficient software then...

Articles described here are in an advanced state of preparation but circumstances may dictate changes to the final contents.

THREE DEE

Our Reflections series takes a new twist this month with the introduction of the third dimension. This amazingly compact routine uses mathematical rules to produce 3D wire drawings complete with hidden line removal and, although written for the Apple, is adaptable to any system with line drawing capabilities. So, if you've got a DAI, ATOM, BBC, Compucolor, etc, be the first on your block to make the step to THREE DEE!

MAKE MORE OF IT

Does your micro sometimes just seem to sit and stare at you? Does it beg to be given real work to do for a change? Now, at long last, you can satisfy its cravings. From our next issue we'll be starting a series of features on the mechanics of storing and retrieving information with your computer. The series starts with a look at how to get information onto and off tape — the first step to producing your own data base. This is the Year of Information Technology, why not join in?

THE SOFT CENTRE

After howls of public outrage and acres of mail complaining about the lack of those soft cuddly bits, we're back with a vengeance. Yes, the SOFTSPOT is here to stay — so tune in to next month's issue for another juicy dollop of those friendly little programs everyone seems to love!

OH, YES...

Needless to say, we'll also have our usual monthly regulars plus a number of extra special features that you really wouldn't want to miss, like a critique on The Valley, a close look at a new micro and lots more besides.

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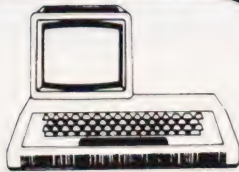
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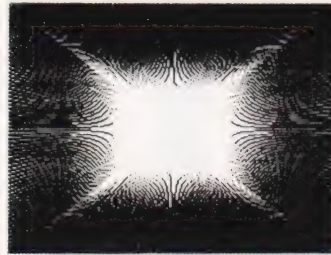
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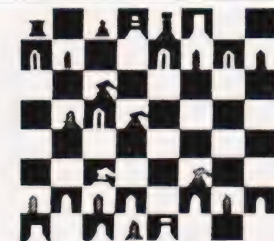
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BASIC ON DISPLAY

Tony Lacy

Watch your Tandy's BASIC at work with this versatile debugging aid. Once used you'll wonder how you ever managed without it!

Many TRS-80 owners, I am sure, are attempting to unravel the secrets of their BASIC interpreter and finding it a most frustrating experience.

There are several aids available which allow us to examine machine code programs: disassemblers, Tandy's own T-BUG and, for disc users, the excellent DEBUG. But they all give a static display. What we really need is a way of examining the flow of information produced as a BASIC program executes.

Obviously it is not going to be much help examining the ROM locations as they won't change but there is an area of RAM called the scratchpad which holds temporary variables and other vital information. If we can observe this as a program runs we can gain a few clues about the operation of the interpreter.

In addition, this program also demonstrates a way of extending BASIC by adding new commands. Using more sophisticated examples of the method shown here you will be able to create your own Level N BASIC.

Getting It Running

At this stage we must assume that you have a Level 2 BASIC, although some modifications for disc BASIC use will be given later.

The first operation is to generate the object program, either by typing in the source code as illustrated with an editor/assembler or by using T-BUG's M function to enter the Hex code. Note that if you use the latter method, it will not be easy to relocate the program and several jump addresses will have to be altered.

One point to note about the assembler used to generate the source listing is that it does not print out the ASCII strings generated by the DEFM pseudo-operation at lines 1940 and 1950. These have been inserted by hand during the setting of the program.

Your next task is to make a system tape; the entry point is the start address (INIT in the source listing). If you are using T-BUG, the command will be of the form:



```
P BE00 BF42 BE00 NAMEIT
```

Now Reset the machine, specify the appropriate MEM SIZE and load the program under SYSTEM. Press '/' then 'Enter' and the READY prompt should appear. You can now carry on as normal; at this stage I would suggest that you load a small BASIC program which loops continuously to try out the new command.

To initialise the command, type:

```
PRINT &BUG,XXXX
```

where XXXX is any valid Hex address. The program performs its own syntax checks and will return an error if the address was incorrect. Note that disc users will find execution drops through to the normal &HXXXX processing and may return an error message from there.

If you RUN your BASIC program, the top line of the screen display will fill with various numbers. These are the displays of the various scratchpad registers and will be explained later. This display is independent of the BASIC program and does not affect scrolling or cursor positioning in any way.

Your now have access to a

number of sub-commands which will be explained in the next section. It is also worth noting that when running in a display mode, the &BUG program slows down program operation and care will be needed when carrying out time-dependent operations such as CLOAD or CSAVE.

To turn off the display, and to remove the delays at the same time, press the C and D keys together (Clear Display). If you wish to re-activate &BUG simply repeat the initialise command above.

The &BUG Sub-commands

The program gives the user an extra four commands which are activated by pressing pairs of keys.

- | | |
|----------------|---|
| Delay | Press D and E. Inserts an extra delay to make viewing easier. |
| Cancel Display | Press C and D. Returns to normal operation as explained above. |
| ReSet mode | Press R and S. Removes the delay and the single step feature but retains the display. |

Step Press S and T. Puts the BASIC program into single-step mode, the Shift key controlling the program operation.

The single-step feature can give some puzzling results and therefore requires some explanation. Unlike the PAUSE operation built into BASIC, it actually halts the program; the only operation that continues is the interrupt servicing for Disc BASIC. While &BUG is waiting for the Shift key to be pressed it will not respond to any other sub-commands. Further to this, it is possible for &BUG to be entered several times while executing a single BASIC statement and this may give the appearance that nothing is happening; the reasons for this will become clear as you read the next section!

A New Command

The secret of adding new commands lies in the concept of 'jump vectors'. The designers who wrote the original TRS-80 software were very much aware that a certain amount of flexibility would be required for future expansion (Disc BASIC for example) yet the programs they were writing were to be frozen in ROM. The answer is to jump out of ROM at certain strategic points which gives us the opportunity to divert the program flow.

These jumps can be set up in RAM when the machine is powered up and can then be changed to suit our purposes. There are several areas used, that between 4152 and 41A3 Hex contains the jump-backs for the Disc BASIC reserved words and gives an 'L3 ERROR' if called from Level 2 BASIC. The jump that has been chosen resides at 4194 Hex and now responds to the reserved word '&' providing the jump to the &BUG program. The original jump is stored and is used if &BUG is not in operation or there is a Syntax Error so that the computer can carry on as though nothing has happened while still giving the correct error message. This part of the program also obtains and stores the address of the section of memory we want displayed.

The next requirement for a dynamic display is to break into the sequence of operations at a frequently used point. The area between 4000 and 4012 Hex contains the jump vectors for the RST instructions and is the most suitable point. These RST instructions operate like

```

4124=> 8A F0 FF FF FF FF FF FF FF FF FF FF 20 20 20 20 <@65535>

MEM SIZE PROTECTED YOUR HEX PROGRAM?

4 BYTE ADDRESSES PLEASE

START ADDRESS (HEX) ?
BREAK IN 40
READY
>?&BUG,4124
READY
>
>
_

```

Fig. 1. How the screen looks when &BUG is running.

subroutine calls except that they are to certain fixed locations and, unlike a normal CALL, they only take a single byte of memory. There are eight RST's for the Z80 and they cause jumps to addresses between 0 and 38 Hex. Each RST is usually labelled with the address that it calls, RST 10 for example (the opcode for this would be D7 instead of the CD 10 00 required for a CALL). If you look at the contents of location 10 Hex you find a jump to 4003 Hex; once again the jump vector idea is being used with the byte-saving RST employed in ROM to call an address in RAM.

The RSTs will be reserved for the most commonly used subroutines and the vectors associated with them are suitable candidates for inspecting the operation of the interpreter. Indeed, the RST 10 instruction is often called several times during the course of a single statement, hence the apparent anomaly with the single-step function. Since the RST calls are so fundamental to the operation of the program, it is essential to save the original vector and jump there when we exit from whatever program we have inserted.

The new command link works in the following way:

1. To initialise, re-vector reserved word '&'.
2. To activate, re-vector RST 10 and save original jump.
3. To de-activate, restore original RST 10 jump.
4. The '&' jump vector remains in place.

&BUG's Display Format

The diagram shown in Fig. 1 shows the general layout of the display. The first four Hex digits indicate the address of the first byte following the '= >' symbol; this should be the one you selected using the PRINT &BUG, XXXX command. The next 16 Hex values are the contents of the next 16 addresses.

The character following the '<' symbol is a mode indicator and has the following states:

- @ Normal display mode.
- D Extra delay mode.
- S Single-step mode.
- W D and S combined.

The next group of decimal digits is the current line number of the BASIC program being executed or 655365 if in command mode. This duplicates the TRON function of BASIC except that the line number stays in one place instead of wiping out your program results.

The display ends with a '>'.

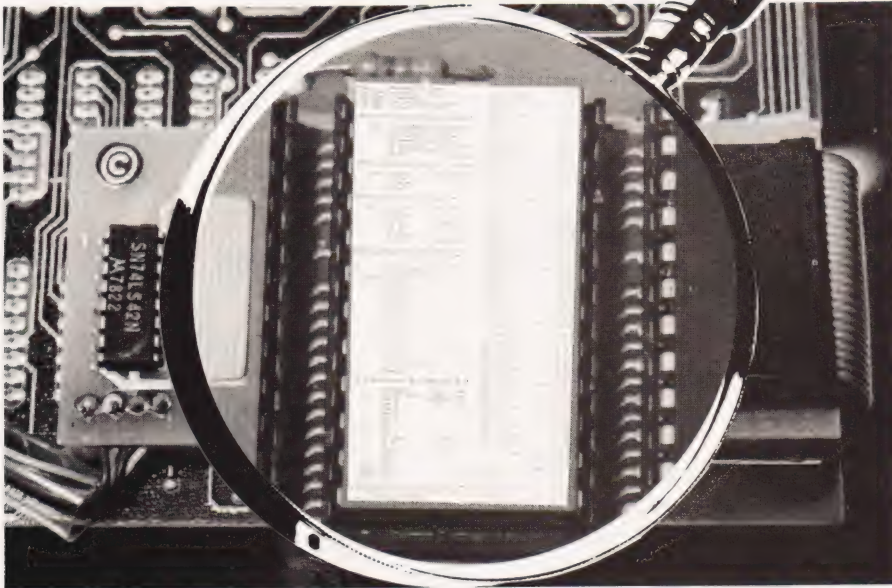
Program Structure

Breaking the program down into its main sections for the purposes of explanation we get:

INIT This section runs just once and its purpose is to divert the jump at 4194 Hex to the start of the new command and saves the original jump address.

When patching in new programs, it is often a good idea to re-

BASIC ON DISPLAY



The utility will give you a 'close-up' view of your BASIC!

tain the original jump on exit rather than assuming that you know what it should be. This ensures that any existing patches which you may not be aware of will not be disturbed — Tandy software writers, please take note! The jump to 06CC Hex avoids the annoying OM ERROR when returning to BASIC via 1A19 Hex but otherwise achieves the same result.

ENTRY This is where execution will now go when the '&' statement is encountered; at this point in the proceedings the HL register pair will point to the '&' in the program text. This position must be saved in case the syntax check shows that &BUG has not been invoked so that the normal error processing can occur. RST 10 is used next in its normal role, that of incrementing the HL register pointer to the next non-space character.

SN This section compares the next four characters with the characters stored in MESS to see if they are 'BUG,'. If they are not, the HL register contents are restored and execution continues as if nothing had happened.

If the characters do match the MESS, the next four characters are checked to see if they are valid Hex digits. If not, the BASIC program continues, otherwise they are stored in two forms: once for display on the screen as ASCII characters and once as binary for the program to make use of later. The conversion from ASCII Hex to binary is performed by the routines ASCHEX and HEX.

The next operation is to divert the jump associated with RST 10; when this is achieved we will return to the command mode. What, you may be wondering, is the purpose of those POPs? After all, only one POP should be needed to 'balance' the equation and, furthermore, what is that NOP doing?

To explain this, a short digression is required but it does serve to show why, when you are trying to untangle those ROM routines, you often seem to end up in the land of never-never.

RETURNS That Don't

The machine code RET instruction is usually regarded as the equivalent of a RETURN in BASIC and is most often used in this way. However, in many parts of the interpreter, it is used somewhat differently. The actual mechanism of the RET instruction is to take the value which the stack pointer is pointing to and place this in the program counter—the stack pointer is then incremented.

If this value happens to be the calling address then the program will continue from this address (this is the way that subroutines are implemented from machine code).

There are, however, other instructions, such as PUSH which uses the stack area, and some of the 16-bit registers which can be exchanged with the stack pointer. The point is that the RET doesn't always get us back to the calling location. When BASIC processes a statement, a part of the interpreter loads the stack area with a series of addresses which represent a route map

through the interpreter and the program is steered by a sequence of RET instructions. These must be treated as jumps and as each one is executed, the next one is pointed to by the stack pointer. Execution usually ends up at 1DE1 Hex and this will be found somewhere at the top of the stack area; the procedure is further complicated by the fact that all conventional calls and returns, as well as POPs and PUSHes, are taking place at the same time.

When the BASIC program text '&BUG,' is encountered, the interpreter makes certain assumptions about the statement '&' and sets up the stack area ready for the journey through ROM. We, however, want an immediate return to BASIC command mode on successful exit from this section of the program. So, we simply do a series of dummy POPs until the address 1DE1 Hex appears at the return point and then do a RET.

You will have deduced from the above that when you see a RET instruction in ROM, the place that the program branches to could have been determined many instructions ago and is hidden somewhere in the stack area.

Now, what about the NOP? Well, when the program was originally assembled and debugged, I inserted several NOPs to provide a breathing space in case things needed to be moved around. The one that remains is a relic from this stage of the development which simply got left behind — well, we're only human!

The rest of the program is very simple. Since RST 10 is called from various areas, all of the used registers are saved to make the display section transparent to normal operation. The only effect is the delay caused by the time taken to run through the various checks.

The Rest Of It

The remaining sections of the program are as follows:

BUG This section finds which bit of memory is to be displayed, converts the contents into ASCII form and puts them onto the screen.

LINE NUMBER TRACE This gets the display mode onto the screen and then displays the contents of address 40A2 Hex which happens to be the current line number. The conversion required this time is to decimal ASCII.

Program Listing

```

LENGTH EQU 16      Memdump line length
AMPERS EQU 4194    &--Existing jump vector
SCR EQU 3C00       Screenstart
RST 10 EQU 4004    RST 10--Existing vector
LINHEX EQU 40A2    Current line no here
  
```

** THIS SECTION EXECUTED ONCE ONLY AFTER LOAD **

```

BE00 2A 95 41      INIT   LD HL,(AMPERS+1)  Get existing
BE03 22 6A BE      LD (SAVED+1),HL  Save it
BE06 21 15 BE      LD HL,ENTRY      Get new
BE09 22 95 41      LD (AMPERS+1),HL Install it
BE0C 2A 04 40      LD HL,(RST 10)   Get existing
BE0F 22 1E BF      LD (VECTOR+1),HL Save it
BE12 C3 CC 06      JP 06CC          Avoids OM ERR
  
```

** THIS SECTION EXECUTED WHEN '&BUG,----' FOUND **

```

BE15 E5            ENTRY  PUSH HL          Save for EREX
BE16 D7            RST 10
BE17 11 34 BF      LD DE,MESS
BE1A 06 04         LD B,4
  
```

** SYNTAX CHECK OF TEXT:-'&BUG,XXXX' **

```

BE1C 7E            SN     LD A,(HL)        Get text chr
BE1D 4F            LD C,A
BE1E 1A            LD A,(DE)
BE1F 91            SUB C          Compare it
BE20 23            INC HL        Try next
BE21 13            INC DE
BE22 20 44        JR NZ,ERROR   Not same
BE24 10 F6        DJNZ SN       Try again
  
```

** GET MEMORY DISPLAY REQUEST INTO MEMORY IN **
 ** BOTH ASCII AND HEX FORMS FOR USE LATER **

```

BE26 06 02         LD B,2          Do it twice
BE28 DD 21 2D BF   LD IX,ASCMMEM  For ASCII
BE2C 11 2C BF      LD DE,MEMHEX+1 For Hex
BE2F 7E            ASCHEX LD A,(HL)
BE30 DD 77 00      LD (IX),A
BE33 CD 5B BE      CALL HEX
BE36 87            ADD A,A
BE37 87            ADD A,A
BE38 87            ADD A,A
BE39 87            ADD A,A
BE3A 4F            ADD C,A
BE3B 23            INC HL
BE3C DD 23        INC IX
BE3E 7E            LD A,(HL)
BE3F DD 77 00      LD (IX),A
BE42 CD 5B BE      CALL HEX
BE45 B1            OR C
BE46 12            LD (DE),A
BE47 1B            DEC DE
BE48 DD 23        INC IX
BE4A 23            INC HL
BE4B 10 E2        DJNZ ASCHEX
BE4D E5            PUSH HL
  
```

** SYNTAX OK SO REVECTOR RST 10 TO TURN &BUG ON **

```

BE4E 21 6C BE      LD HL,BUG      Start of BUG
BE51 22 04 40      LD (RST 10),HL Install new
BE54 E1            POP HL        Restore text
BE55 C1            POP BC
BE56 C1            POP BC
BE57 C1            POP BC
BE58 C1            POP BC
BE59 00            NOP
BE5A C9            RET
BE5B D6 30         HEX    SUB 30
BE5D 38 08         JR C,EREX     < 30 Hex?
BE5F FE 0A         CP 0A        > 10?
BE61 D8            RET C
BE62 D6 07         SUB 7
BE64 FE 10         CP 10        >15?
BE66 D8            RET C
BE67 C1            EREX  POP BC
BE68 E1            ERROR POP HL
BE69 C3 00 00      SAVED JP 0
  
```

** THIS IS THE PROGRAM PROPER. IT IS EXECUTED **
 ** EVERY TIME AN RST 10 IS USED BY BASIC **
 ** (WHEN ACTIVE). **
 ** MEMORY DUMP SECTION **

```

BE6C E5            BUG   PUSH HL
BE6D D5            PUSH DE
BE6E C5            PUSH BC
BE6F F5            PUSH AF
BE70 DD E5        PUSH IX
BE72 21 2D BF     LD HL,ASCMMEM
BE75 11 00 3C     LD DE,SCR
BE78 01 07 00     LD BC,7
BE7B ED B0        LDIR
BE7D 2A 2B BF     LD HL,(MEMHEX)
BE80 06 10        LD B,LENGTH
BE82 7E            LD A,(HL)
BE83 F5            PUSH AF
BE84 CB 3F        SRL A
BE86 CB 3F        SRL A
BE88 CB 3F        SRL A
BE8A CB 3F        SRL A
BE8C CD 20 BF     CALL CONV
BE8F F1            POP AF
BE90 E6 0F        AND 0F
BE92 CD 20 BF     CALL CONV
BE95 23            INC HL
BE96 3E 20        LD A,20
BE98 12            LD (DE),A
BE99 13            INC DE
BE9A 10 E6        DJNZ LOOP1
  
```

Save register
to ensure
transparency

Convert Hex
into ASCII
Hex

** LINE NUMBER TRACE SECTION **

```

BE9C 3E 3C        LD A,'<'
BE9E 12            LD (DE),A      Display it
BE9F 13            INC DE
BEA0 3A 38 BF     LD A,(MODE)
BEA3 12            LD (DE),A
BEA4 13            INC DE
BEA5 2A A2 40     LD HL,(LINHEX)
BEA8 DD 21 39 BF   LD IX,TABLE
BEAC DD 4E 00     LD C,(IX+0)
BEAF DD 46 01     LD B,(IX+1)
BEB2 3E 2F        LD A,2F
BEB4 B7            OR A
BEB5 3C            INC A
BEB6 ED 42        SBC HL,BC
BEB8 30 FB        JR NC,LOOP3
BEBA 09            ADD HL,BC
BEBB 12            LD (DE),A
BEBC 0D            DEC C
BEBD 13            INC DE
BEBE 28 06        JR NZ,DUN
BEC0 DD 23        INC IX
BEC2 DD 23        INX IX
BEC4 18 E6        JR LOOP2
BEC6 3E 3E        DUN   LD A,'>'
BEC8 12            LD (DE),A
  
```

** THIS SECTION SCANS THE KBD FOR A MODE CHANGE **

```

BEC9 3A 01 38     LD A,(3801)
BECB FE 18        CP 18
BECE 28 25        JR Z,CANCEL
BED0 FE 30        CP 30      D and E?
BED2 20 08        JR NZ,SSTEP
BED4 3A 38 BF     LD A,(MODE)
BED7 F6 44        OR 'D'
BED9 32 38 BF     LD (MODE),A
BEDC 3A 04 38     SSTEP  LD A,(3804)
BEDF FE 18        CP 18      S and T?
BEE1 20 08        JR NZ,RESET
BEE3 3A 38 BF     LD A,(MODE)
BEE6 F6 53        OR 'S'
BEE8 32 38 BF     LD (MODE),A
BEEB FE 0C        RESET  CP 0C      R and S?
BEED 20 0E        JR NZ,DUMP
BEEF AF           XOR A
BEF0 32 38 BF     LD (MODE),A
BEF3 18 22        JR CARYON
BEF5 2A 1E BF     CANCEL LD HL,(VECTOR+1) Restore old
BEF8 22 04 40     LD (RST 10),HL vector then
BEFB 18 1A        JR CARYON exit
  
```

** THIS SEGMENT FINDS DISPLAY MODE **
 ** AND EXECUTES IT **

```

BEFD 3A 38 BF     DUMP  LD A,(MODE)
BF00 B7           OR A
BF01 28 14        JR Z,CARYON
BF03 FE 53        CP 53
BF05 28 08        JR Z,WAIT
BF07 01 00 20     DELAY LD BC,2000
BF0A F5           PUSH AF
BF0B CD 60 00     CALL 60
  
```

Find mode
Reset mode?

BASIC ON DISPLAY

BF0E F1		POP AF
BF0F 38 06	WAIT	JR C,CARYON
BF11 3A 00 38	STEP	LD A,(3800)
BF14 B7		OR A
BF15 28 FA		JR Z,STEP
BF17 DD E1	CARYON	POP IX
BF19 F1		POP AF
BF1A C1		POP BC
BF1B D1		POP DE
BF1C E1		POP HL
BF1D C3 00 00	VECTOR	JP 0
BF20 C6 30	CONV	ADD A,30
BF22 FE 3A		CP 3A
BF24 38 02		JR C,VID
BF26 C6 07		ADD A,7
BF28 12	VID	LD (DE),A
BF29 13		INC DE
BF2A C9		RET
BF2B 00 00	MEMHEX	DEFW 0
BF2D 00 00	ASCMMEM	DEFW 0
BF2F 00 00		DEFW 0
BF31 3D 3E 20		DEFM '=> '
BF34 42 55 47 2C	MESS	DEFM 'BUG,'
BF38 00	MODE	DEFB 0
BF39 10 27	TABLE	DEFW 10000
BF3B E8 03		DEFW 1000
BF3D 64 00		DEFW 100
BF3F 0A 00		DEFW 10
BF41 01 00		DEFW 1

KEYBOARD SCAN The keyboard is treated as a group of memory locations and key presses alter the contents of these locations. The values from this scan are used to set a mode flag at MODE or to cancel the operation of the program.

DUMP, DELAY and STEP Each of these sections is only a few bytes long and the comments in the source listing should be adequate.

CARYON The registers are restored and control is returned to BASIC via the jump vector which was originally at 4004 Hex.

Where From Here

It is probably worth suggesting a couple of areas of general interest which can be looked at while a BASIC program RUNning. The area of RAM between 4041 and 4130 Hex is particularly interesting, with temporary variables being stored around 4121 Hex. You will find other addresses with values relating to line number, cursor position, etc and many of these will be changing as you watch.

Another interesting area is the stack. This will be in high memory, somewhere below the reserved memory area. As I indicated above, this is also an area of continual change. Program variables can be found just above the BASIC program itself; in fact, a few modifica-

tions to &BUG would allow display of BASIC variable values in decimal as a program is run.

Disc BASIC Usage

Users of Disc BASIC will have to do a little work here I'm afraid — there are some snags. First, the jump in INIT to 06CC Hex will have to be changed to 402D Hex, but that is the least of your problems.

The jump to 4194 Hex is not used by DOS so in its present form, &BUG will only operate from BASIC.

You can save the object code as a CMD file which will load and initialise normally but when you enter BASIC from DOS, not forgetting to set the memory size, the jump vector at 4195 Hex will be reset. You can either find a way round this problem or simply POKE the values back in from BASIC.

Owners of NEWDOS can use CMD"FILESPEC" to load the program while in BASIC but they will also find the jump vector reset on return to BASIC. If anyone has discovered a way round this problem I would be delighted to know!



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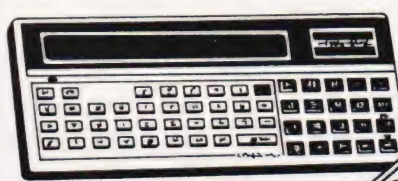
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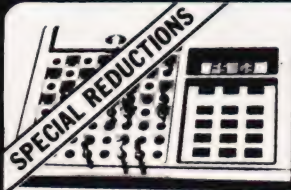
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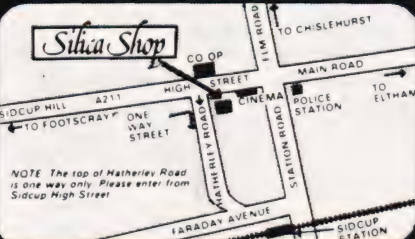
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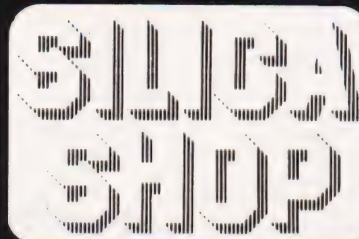


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BOMB RUN

Flying your 'plane is easy... but landing?

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This program occupies less than 1K of RAM and will run on an unexpanded NASCOM 1 under the NAS-SYS 1 monitor. The program will also run under other monitors or even in different (Z80) systems with a few alterations. A few notes are given later to aid those who wish to make such alterations to the program.

To play the game, the program should be executed from 0C80 Hex by using the monitor 'E' command. The subsequent display consists of a graphical representation of an aeroplane which starts in the top left hand corner and moves across and down the screen, and a pattern of white blocks at the bottom of the screen representing buildings. The object of the game is to destroy the buildings, by dropping bombs from the plane, in order to clear a landing place for the plane. Bombs are dropped from the plane by pressing any key on the keyboard, but you may only have one bomb in the air at any one time (otherwise the game would be too easy). The strength of each bomb is decided by randomly generating a stream of pseudo-random numbers.

A point is scored for every block destroyed and the total is displayed on the top line of the screen. If you manage to completely destroy the buildings then the game will restart and progress at a faster pace in which case the points total will be carried over between games. If you fail however, the program will ask you if you wish to continue playing the game; 'N' will clear the screen and return control to NAS-SYS, 'Y' will give you another try.

Program Alterations

The following notes should be of help to those of you wishing to modify the program in order to allow it to run under monitors other than NAS-SYS 1.

The NAS-SYS monitor uses the Z80 restart instructions for calling all its subroutines. These will have to be replaced by CALL instructions for most other monitors. Three of the routines (PRS, RDEL, and RIN) used in this program are called using a specific restart for each one; the other three monitor routines are

each called by putting the code DFH (RST 18 Hex) in the program followed by the number of the routine to be called. The routines used by the program are described below. If any of these are replaced by CALL instructions then some other parts of the program will need relocating to fit in the extra bytes. The displacements for the relative jumps will also need re-calculating.

Code	Routine	Function
EF	PRS	Print the following ASCII codes until 00 Hex is found.
CF	RIN	Input character in accumulator.
FF	RDEL	Delay for approximately 5 mS @ 2 MHz.
DF 62	IN	Scan keyboard; if key pressed then return with character in the Acc and set carry flag else return with carry reset.
DF 7C	CPOS	Return with position of first character on the line (pointed to by the cursor) in HL.
DF 5D	TDEL	Delay for approximately 2 sec @ 2 MHz.

Address 0C29 Hex is used by NAS-SYS to hold the cursor address; this will need to be altered to suit the monitor being used. This of course means that the game can only be played on systems which have a memory-mapped display.

The section of code between 0DD Hex and 0DE8 Hex is used to give the NASCOM keyboard a 'repeat' effect. If your keyboard has auto repeat then the corresponding section of code will not be needed in your system. The only other point which may need some explanation is the random number generator. The method employed is to simulate a feedback shift-register in software (this is done between 0D86 Hex and 0D8F Hex). The seed for the generator, set at the beginning of

the game, is held at address 0F02 Hex; any number other than zero may be used.

The section of memory from 0CA3 Hex to 0D61 is used to store the pattern for the buildings. A detailed copy is not included in the program listing as it would take up quite a large amount of space, however, it is very easy to design your own pattern in the following manner. The first 48 bytes represent the third line up from the bottom of the screen, the next 48 the second line up, the next 48 the first line up and the remaining bytes represent the bottom line of the screen. Where you require a block to appear on the screen the value 7F Hex should be included in the relevant position in memory; for an empty space in the code 20 Hex should be used. As an example, if you want a tower to appear at the left-hand edge of the screen, a 7F Hex should be placed at addresses 0CA3 Hex, 0CD3 Hex, 0D03 Hex and 0D33 Hex. Those of you who are observant will have noticed by now that the bottom right-hand location cannot be defined in this way, this is deliberate and is to guard against accidental scrolling (this location is not visible on many TVs anyway). All there is left to say now is... happy bombing!

Photograph courtesy of THORN EMI Video Programmes Ltd.



Program Listing

0C80	EF	0C	00	START	RST PRS,'CS'	0DBA	7E			LD A,(HL)						
0C83	21	32	0E		LD HL,MESS1	0DBB	FE	20H		CP 20H						
0C86	11	DD	0B		LD DE,0BDDH	0DBD	36	2E		LD (HL),2EH						
0C89	01	06	00		LD BC,0006H	0DBF	28	28		JRZ,MOVE1						
0C8C	ED	B0			LDIR	0DC1	06	03		LD B,03H						
0C8E	EB				EX DE,HL	0DC3	E5			PUSH HL						
0C8F	06	03			LD B,03H	0DC4	21	E7	0B	LD HL,0BE7H						
0C91	23			CLRPNT	INC HL	0DC7	2B			INC DEC HL						
0C92	36	30			LD (HL),20H	0DC8	7E			LD A,(HL)						
0C94	10	FB			DJNZ CLRPNT	0DC9	FE	39		CP 39H						
0C96	21	76	0D		LD HL,DELAY	0DCB	20	06		JRNZ,INC1						
0C99	36	10			LD (HL),10H	0DCD	36	30		LD (HL),30H						
0C9B	21	CA	0A		LD HL,0ACAH	0DCF	10	F6		DJNZ INC						
0C9E	22	29	0C		LD (CURSOR),HL	0DD1	18	01		JR TSTBMB						
OCA1	00				NOP	0DD3	34			INC1 INC (HL)						
OCA2	EF				RST PRS	0DD4	E1			TSTBMB POP HL						
OCA3	)					0DD5	0D			DEC C					
	)	SEE TEXT				0DD6	20	11		JRNZ,MOVE1					
0D61	)					0DD8	36	20		LD (HL),20H					
0D62	00				DEFB 00H	0DDA	21	00	00	LD HL,0000H						
0D63	21	0A	08		LD HL,080AH	0DDD	E5			PUSH HL						
0D66	22	29	0C		LD (CURSOR),HL	0DDE	21	01	0C	LD HL,0C01H						
0D69	21	00	00		LD HL,0000H	0DE1	06	09		LD B,09H						
0D6C	EF			MOVE	RST PRS	0DE3	36	00		CLRKEY LD (HL),00H						
0D6D	11	11	20		DEFS 'CL CL CL SP'	0DE5	23			INC HL						
0D71	2D	2D	09	00	DEFS '...',00H	0DE6	10	FB		DJNZ,CLRKEY						
0D75	06				DEFB 06H	0DE8	E1			POP HL						
0D76				DELAY	DEFS1	0DE9	ED	5B	29	0C	MOVE1 LD DE,(CURSOR)					
0D77	FF			DEL1	RST RDEL	0DED	1A			LD A,(DE)						
0D78	10	FD			DJNZ DEL1	0DEE	FE	7F		CP 7FH						
0D7A	DF	62			RST SCAL,DEFB IN	0DF0	C2	6C	0D	JPNZ,MOVE						
0D7C	30	1B			JRNC,LAND?	0DF3	00			NOP						
0D7E	7C				LD A,H	0DF4	00			NOP						
0D7F	B5				OR L	0DF5	DF	5D		RST SCAL,DEFB						
0D80	20	17			JRNZ,LAND?					TDEL						
0D82	2A	29	00		LD HL,(CURSOR)	0DF7	EF	0C	00	RST PRS,'CS'						
0D85	00				NOP	0DFA	21	38	0E	LD HL,MESS2						
0D86	3A	02	0F		LDA,(SEED)	0DFD	11	5B	09	LD DE,095BH						
0D89	CB	27			SLA A	0E00	01	0A	00	LD BC,000AH						
0D8B	30	02			JRNC,NOC	0E03	ED	B0		LDIR						
0D8D	EE	1D			XOR 1DH	0E05	21	42	0E	LD HL,MESS3						
0D8F	32	02	0F	NOC	LD (SEED),A	0E08	11	9A	09	LD DE,099AH						
0D92	E6	C0			AND COH	0E0B	01	0C	00	LD BC,000CH						
0D94	07				RLC A	0E0E	ED	B0		LDIR						
0D95	07				RLC A	0E10	CF			INPUT RST RIN						
0D96	C6	01			ADD A,01H	0E11	FE	59		CP 'Y'						
0D98	4F				LD C,A	0E13	CA	80	0C	JPZ,START						
0D99	E5			LAND?	PUSH HL	0E16	FE	4E		CP 'N'						
0D9A	2A	29	0C		LD HL,(CURSOR)	0E18	20	F6		JRNZ,INPUT						
0D9D	11	B6	0B		LD DE,0BB6H	0E1A	EF	0C	00	RST PRS,'CS'						
0D0A	ED	52			SBC HL,DE	0E1D	DF	5B		RST MRET						
0D02	E1				POP HL	0E1F	21	76	0D	LANDED LD HL,DELAY						
0D03	30	7A			JR NC,LANDED	0E22	3E	FE		LD A,FEH						
0D05	7C				LD A,H	0E24	86			ADD A,(HL)						
0D06	B5				OR L	0E25	20	02		JRNZ,STORE						
0D07	28	40			JRZ,MOVE1	0E27	3E	02		LDA 02H						
0D09	36	20			LD (HL),20H	0E29	77			STORE LD (HL),A						
0D0B	11	40	00		LD DE,0040H	0E2A	EF			RST PRS						
0D0E	19				ADD HL,DE	0E2B	08	08	08	00	DEFS 'BS BS BS'					
0D0F	E5				PUSH HL					00H						
0DB0	DF	7C			RST SCAL,DEFB	0E2F	C3	98	0C	JP 0C9B						
					CPOS	0E32	50	4F	49	4E	54	53				
0DB2	11	C0	0B		LD DE,0BCOH	0E38	48	41	52	44	20	4C	55	43	4B	21
0DB5	ED	52			SBC HL,DE	0E42	41	4E	4F	54	48	45	52			
0DB7	E1				POP HL		20	54	52	59	3F					
0DB8	30	20			JRNC,NOBOMB											

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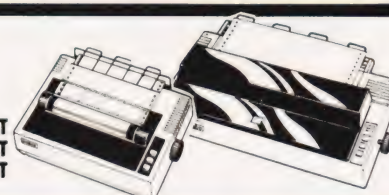
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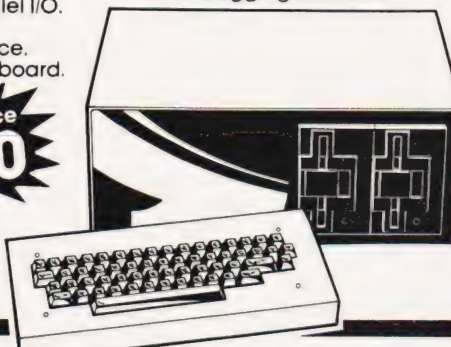
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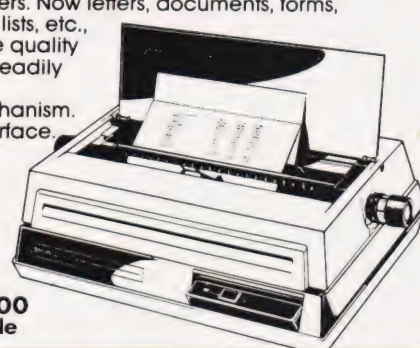
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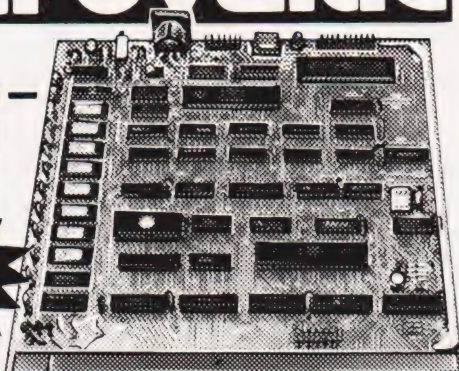
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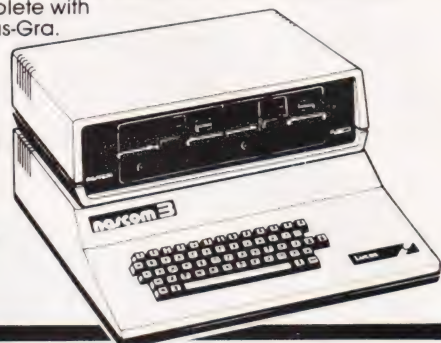
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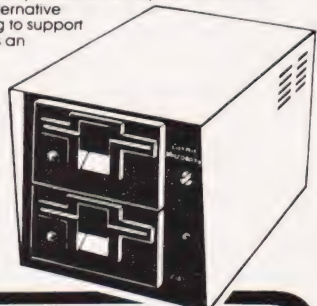
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Could this be the hand-held computer that all the rest try to follow? It certainly is an exceptionally powerful package as our reviewer explains.



If you ever thought that the PC-1211 was an impressive little piece of machinery then the latest offering from Sharp, the PC-1500, is a whole new experience.

Weighing in at a mere 13 ounces — that's about the same as 1½ copies of this magazine — the PC-1500 is slightly bigger than its predecessor measuring 195mm by 86mm by 25mm (the extra weight is certainly helpful when using it on a table top). Just like the PC-1211, a typewriter-style keyboard is featured but on the PC-1500, the keys are even closer in spacing to the real thing. The usual top row of numeric keys is missing, a numeric keypad being located on the right instead. This keypad also includes the usual arithmetic function keys and some punctuation symbols. Unfortunately, symbols such as commas, colons and semi-colons are only accessible through the Shift key which operates as on the PC-1211: Shift then key. However, as you can define several of the other keys on the keyboard to perform different functions, you can easily get around this if you wish.

Various other symbols are dotted around the keyboard and these include a square root and pi sign as well as the cursor controls which double up as editing keys. All the keys have the feel of a good quality

calculator but you certainly won't win any prizes for speed typing as the computer simply cannot keep up. However, this is no real disadvantage since, although Sharp mention wordprocessing in their documentation, it is a little far-fetched. I would still rather use the PC-1500 keyboard than that on my ZX81 though!

On Display

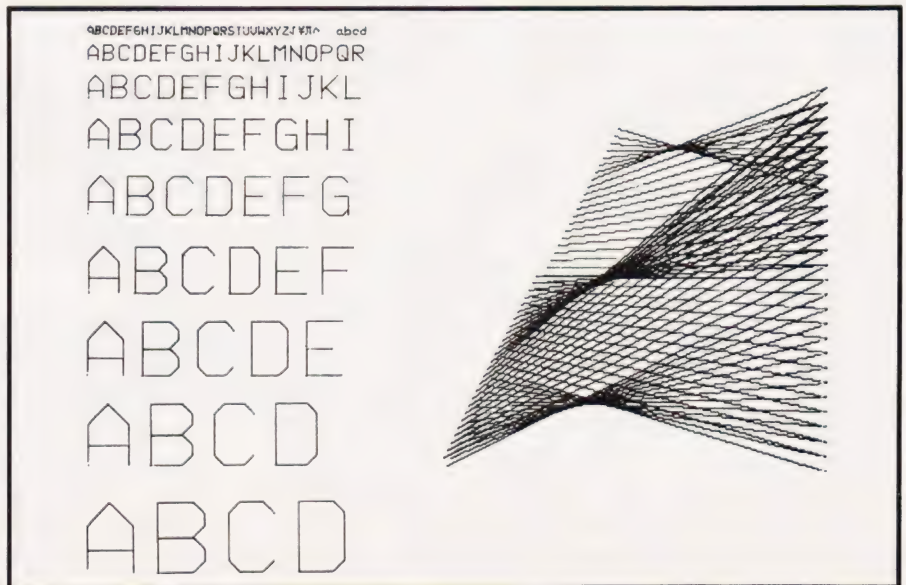
The LCD display strip shows 26 characters at a time and the total line length can be up to 80 characters, based on a 5 by 7 matrix. As an improvement over the PC-1211, the new machine offers lower case, without descenders, and most of the ASCII set is made available. One or

two of the characters have been re-allocated, for example, code 39 is used as a special editing symbol instead of the usual apostrophe. The editor inserts this character every time you 'insert'; if any are left unused when you Enter the line, the system automatically deletes them — simple but an example of the thought that has been put into the machine. The only truly irritating character is the lower case 'L' which shows up as a single vertical line.

The dots of the display are individually addressable so you can have dot resolution graphics on a 7 by 156 display — the later section on the BASIC will cover this point in further detail.

The Physical Machine

The case is, if anything, slightly better made than that of the PC-1211 — that is to say 'nice'. A couple of extra features have been incorporated: provision for a mains power unit, normal AA size batteries instead of mercury cells, connection for a 4 or 8K RAM pack and the expansion port.



Right: The range of typefaces and an example of 'string art' drawn by the CE-150.

PC-1500 REVIEW

The batteries caused a slight panic when the system arrived — we couldn't get the machine to work once we had fitted them. Programs were entered and promptly forgotten and tempers became frayed. However, after long and careful study of the manual, we discovered that you have to tell the brute that you have changed its power source... indeed it actually asks you if you have replaced the batteries. Red faces all round!

Subsequent dismantling of the machine for photography meant that we had to take the batteries out, yet we found the program stored in the machine was still present when we reassembled it some fifteen minutes later. I suspect, however, that this is not recommended practice!

The expansion connector consists of a 60-pin female connector. No information is provided about the signals present but it seems that considerable expansion will be possible.

General Operation

The system operates in three distinct modes: RUN, PROgram and RESERVE. The former two are selected on a toggle basis by the red MODE key. In RUN mode, programs can be executed and immediate mode commands will also operate.

Program execution makes use of the DEF facility by allowing programs to be labelled. This means that you can store a number of different programs and select the one you want — keying 'DEF C', for example, will cause the program labelled C to run. You can also create 'auto RUN' programs by including the command ARUN as the first statement and turn-

ing the machine off in RUN mode. Then, simply turning the power back on will execute the program.

In the PRO mode, programs can be entered and edited. If an error is detected in a program on running it, you have to switch modes before you can edit. The editing is carried out with the four cursor keys which move the current displayed line up and down, and shift the cursor left and right. If a line will not fit in the 26 characters available, the displayed line can be scrolled using the cursor right key. When a line scrolls, its line number is kept static at the beginning of the line, which is extremely useful should you forget which line you are editing. The Delete and Insert keys can be used to alter program lines in much the same way as on the CBM and MZ-80A *et al.* As all keywords are stored in a single step of memory, they can be deleted with a single depression of the Delete key.

The RESERVE mode is entered by pressing Shift and then MODE. It can be left by pressing the MODE key on its own, which will return you to the RUN mode. In the RESERVE mode the top row of six keys may be defined. These keys are used in conjunction with a three level shift control, giving in effect 18 user definable keys. A Roman digit (I, II or III) is displayed at the top of the display to indicate which of the three levels is current. Levels are changed by pressing the double arrow key, next to the space key. To define a key, you enter RESERVE mode, select the required level, press the key to be defined, type the text to be stored under the key and press 'Enter'. All the keys can be cleared by typing NEW in this mode. If any keys are not

defined, they take on the shifted characters written above the keys on the keyboard.

With 18 keys, it is easy to forget what keys are doing what, so a means has been devised to display the uses of the keys. Any text typed between quotes, not assigned to any specific key, will be stored under the RCL key. When you go back to RUN or PRO mode, pressing the RCL key will bring back the text. Thus, if you store some information under the RCL key at each level relating to the functions of the keys at that level, you have an instant reminder. Using the @ symbol, Return characters can be placed in the string of characters stored in a key. This allows full commands to be stored and recalled, without the need for the user to press 'Enter'.

As an aid to quick programming, a number of common commands have been pre-defined and reside under the top row of alpha keys. The functions are called by pressing DEF then the required key — an overlay is provided as an aide memoir until you become familiar with the system.

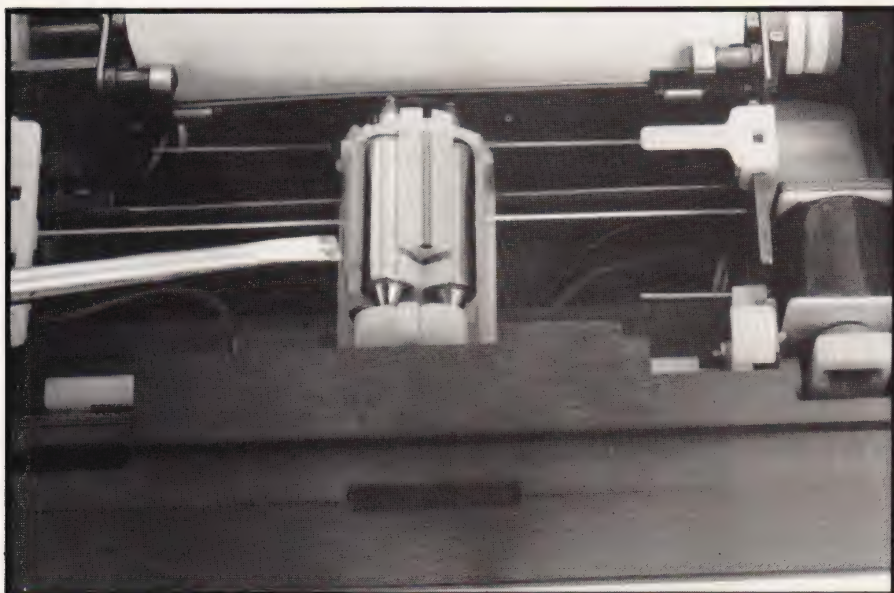
Basically Speaking

The BASIC supplied with the PC-1500 occupies some 16K of ROM, together with whatever monitor/operating system is present. It seems to be an off-the-shelf Microsoft package, not least because there are some features of Microsoft which are valid in PC-1500 BASIC which are not mentioned in any of the manuals. Because of the close similarity with Microsoft, I will only cover those statements not supported in the former.

The only features of Microsoft's 8K BASIC not supported, as far as I can tell, are the provision of user defined functions, POKE, PEEK, USR and integer variables. User defined functions are extremely useful but the others seem a little out of context in a machine of this type.

The error messages generated by the system are of the form 'ERROR N IN X', where N is the error number and X is the line number where it occurred. These numbers are only explained in the manual; I would have like to have seen a reference card with the messages printed on them. I was interested to note that there is a strong similarity between the error numbers of the PC-1500 and the new MZ-80A from Sharp (Z80A based). Could it be that the machines are in some way related?

ON ERROR GOTO is provided,



Left: The heart of the CE-150. Four tiny ballpoint pens in a rotatable holder.

but as there is no facility for discovering what the error was from inside the routine and equally no information as to its location, the feature is of questionable usefulness!

Before diving into a description of the BASIC statements, PC-1211 users will be pleased to hear that every PC-1211 instruction has been retained. I didn't have a PC-1211 to hand, but it wouldn't surprise me if the two machines could LOAD each other's cassettes.

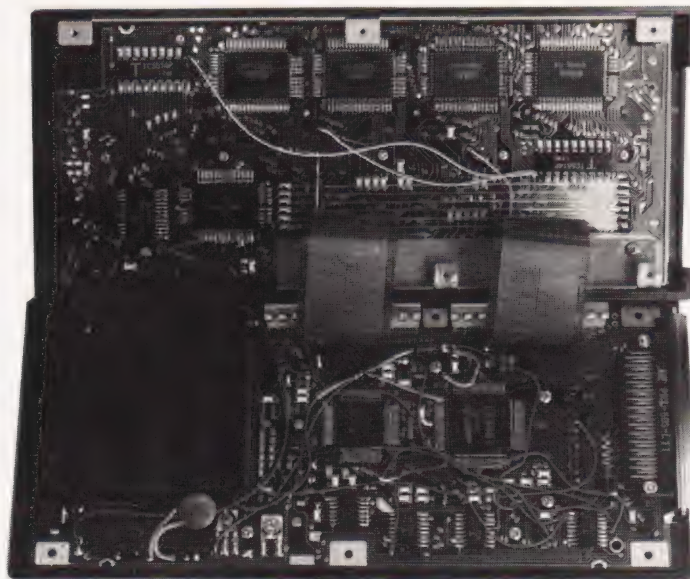
All the familiar string handling commands LEFT\$, RIGHT\$, MID\$, VAL, STR\$ and CHR\$ are provided. The only catch is that all string variables must be of 16 characters or less, unless specifically DIMensioned. Single character variable names of both types are always present thus speeding access to them. The variables @() and @\$() can be used to access any of the simple variables by treating the 52 variables as two arrays, thus @\$ (3) is the same as C\$ and @(20) is the same as T. Multi-character variable names are legal, as long as they follow the accepted rules of 'letter then any alphanumeric character'.

INKEY\$ will read the character currently being pressed on the keyboard. A simple loop printing the ASCII codes of every key pressed produced some fascinating results. First, INKEY\$ takes no account of the Shift key or the DEF key. Both keys generate their own codes, less than 32. I found it intriguing that the DEF key generated a code of 27, normally referred to as ESCape, and is in the same position on the keyboard as the ESCape key on a standard computer keyboard. Terminal activities seem to be in the minds of the gentlemen at Sharp.

A RND function is included, which normally takes an argument greater than 1 to generate an integer random number in the required range. A RANDOMise statement initialize the random number generator.

The graphics commands are also interesting. Commands are provided to set or reset a single row of seven pixels, arranged vertically, of the possible 156 columns. POINT gives the status of any column. When GCURSOR is used to move the graphics cursor to any column, character printing will also start from the same point. As the grid for graphics work is finer than that for character printing, it is possible to over print characters and make them overlap. This technique can also be used to print special characters.

The internal layout of the PC-1500 is incredibly neat and tidy. A copious number of multi-legged ICs abound to provide the processing power.



Some Other BASIC Functions

The list of functions provided for the BASIC programmer could go on and on, so possibly the best way to illustrate the sort of features provided is to refer you to Table 1 which covers some of the more interesting ones.

Statement	Function
ACS	Arc cos.
ASN	Arc sin. (These are not normally available.)
DMS	Converts an angle from degrees/minutes and seconds of an arc to a decimal degree value. The complementary function is also available.
LN	Natural logarithms.
LOG	Logarithms to base 10.
TIME	Real-time clock.
BEEP	Just what it says!
RESTORE	As usual, except that a line number may be used allowing DATA to be stepped through. Debugging functions.
TRON/ TROFF	Formatting command for PRINT.
PRINT	Indicates a Hex constant.
USING	
&	
WAIT	Delay function for the time text stays on the display.

Table 1. Some of the more unusual commands available in the PC-1500's repertoire.

The Printing Package

The cassette interface can support up to two cassette recorders, both with motor control. The leads to the cassette recorders are terminated with 2.5 mm and 3.5 mm plugs since the DIN levels are not sufficient to drive the unit. The firmware providing the cassette commands lives inside the CE-150 — entering the commands without it connected results in a Syntax Error.

Commands are provided to CHAIN programs from either cassette recorder, to CLOAD and CSAVE programs from and to either cassette recorder, and to verify saved programs with CLOAD?

I found the MERGE facility useful when developing programs. However, it would have been more useful if some form of renumber command had been built into the system since the computer will happily merge two programs with the same line numbers.

I found the cassette interface extremely reliable, if somewhat slow. A reassuring feature is that all cassette 'noises' are played through the PC-1500's internal speaker. This can be turned on or off with BEEP ON and BEEP OFF.

The printer/plotter tended to run down the rechargeable batteries of the CE-150 with astonishing speed, so I ran it off the mains adaptor (included in the price) almost exclusively. The tiny rolls of paper were finished in about two days each, but test conditions did necessitate a large number of printouts.

PC-1500 REVIEW



Above: The PC-1500's keyboard layout. The single key programming overlay can be seen.

Left: The cassette interface can handle two tape units.

There were two controls for the printer/plotter part of the CE-150: paper feed and calculation print. The former just advances the paper and the latter allows all manual calculations carried out in RUN mode to be preserved on the printer.

The plotter itself consists of a small barrel holding four tiny ball-point pens — each about a centimetre long and coloured red, green, blue and black. The required plotting colour is selected by a statement of the form COLOR N, where N is an expression in the range 0 to 3. Whenever this statement is executed, the print head moves to the left-hand side of the paper and rotates until the correct pen is uppermost. This is a time-consuming task at the best of times and requires some skillful programming to minimise the effects of such delays. The actual plotting is carried out by a combination of moving the printhead from side to side and moving the paper up and down. It is a truly fascinating process to watch!

Characters are plotted in the same way as they are generated on vector type CRT displays. Each character is made up of a series of horizontal, vertical and diagonal lines. When text is printed normal size, these changes of direction merge into curves, but in the larger character sizes, you can see the way the characters are actually formed.

The plotter works beautifully and is very well engineered. I can only refer you to the sample printouts for an idea of how well it draws. The disadvantages are the previously

mentioned delay when changing colour, and the way the printhead sometimes makes unnecessary movements when drawing lines.

Table 2 gives a breakdown of the commands associated with the plotting part of the CE-150.

Booking It

The documentation supplied with the system comprised the excellent, if a little dry, applications manual (is this obligatory with pocket computers?) and a user manual. The user manual was good, except for the appalling English. Sharp do not seem content at translating their documents to English, so this manual appears to have been translated into American.

Some of the programs in the application program manual operate without the plotter. Most require it, and some also require the RAM expansion module. They all were of high quality and useful in some sphere of life or other. The bar and pie chart drawing programs, while not up to the HP-83 standard, would be very useful in a business installation, for instance.

On the whole, the documentation is good and very readable. I doubt if a beginner could learn to program it, but someone with experience of programmable calculators should be able to.

The Last Word

Few computer reviewers actually buy the computers they review. However, I was so impressed with the PC-1500 that I bought it (I couldn't af-

ford the company). It is a very pleasant machine to use, it does everything you want and, Clive's Spectrum notwithstanding, is extremely good value for money. The PC-1500's most attractive feature is its size and its ability to interface with the CE-150 printer/plotter/cassette interface. The future apparently holds an RS232 interface and a digitiser. No mention of 3½" discs yet though!

In conclusion, the whole system is a delight to use and well worth the price. We only have to wait for some enterprising company to market software for it now.

Statement	Function
COLOR	Changes plotting/printing colour.
Csize	An expression in the range 1 to 9 sets the size of the characters printed.
GLCURSOR	moves the graphics to coordinates X,Y. (The abbreviation for this command is 'GLC'!!!)
LF	Moves the paper up or down by the specified amount.
LINE	Draws lines, boxes or points. There are ten different types of line, with differing numbers of dashes per inch. The line drawing commands can either take an argument, in which case they draw from the last point visited to the point specified, or they can join two or more points. The colour of the line can also be specified in the LINE statement.
RLINE	Relative form of LINE statement.
LLIST LPRINT	The same as LIST and PRINT, except output to the plotter.
ROTATE	Sets the direction for printing characters. This can be up, down, left or right. An obvious use of this facility is in labelling graphs.
TEST	Prints a test pattern of a box in each colour.

Table 2. The plotter commands

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Snapp-Ware has achieved fantastic success in the United States, but has not really been promoted to any extent in this country. We have now been using Mr. Snapp's utilities for some time and we intend to try our best to change this state of affairs, not only because we want Snapp software to sell, but also we sincerely feel that the Tandy user should have the benefit of these utilities, some of which are capable of cutting the Basic programmer's time down by an astounding amount.

In order to achieve this promotion, we have decided to market Snapp-Ware at the **same price** in the United Kingdom as it is sold for in the United States (the calculations being on prices existing in March 1982 and using \$2 to the pound conversion rate).

The three most important utilities are Extended Basic, Extended Built-in Functions and Garbage Collector. These, and the others, are so comprehensive that it is not possible to describe them in full in this advertisement so a pamphlet has been prepared describing the whole line and is available on request. A short description of the three mentioned follows, but it must not be forgotten that these are all built-in utilities — they are essentially a part of the interpreter and therefore transparent to the user.

EXTENDED BASIC

Single Keystroke Commands There are six, essentially duplicating those in NEWDOS+ for displaying first and last lines etc.

Single Letter Abbreviations There are ten of these covering such commands as EDIT, KILL, CLS and DELETE.

Cross Reference Extensive cross reference for variables and integers.

Dump Dumps all variables to the screen or to the printer with the current values.

Renumber Deluxe renumbering utility, including moving.

Find Locates all strings and basic keywords in a program.

Compress Reduces a program to its minimum configuration.

EXTENDED BUILT-IN FUNCTIONS

The most important function in this suite is a super fast in-memory sort routine capable of sorting (for instance) 2,000 strings in 10 seconds, or 10,000 integers in 39 seconds. These figures are for random items.

In addition, there are about 30 (depends in part on whether it is a Model II or Model III machine) extra commands such as — for the Model II, PEEK and POKE; the ability to read a string straight from the video display on the Model II; returning row numbers on the Model III; packing and unpacking strings on both machines.

GARBAGE COLLECTOR

This utility essentially gets rid of the annoying apparent hang up which is inherent in Microsoft Basic when it is sorting out its string space. The use of this utility means that this problem is really no longer existent. Two versions are supplied, one which uses a working file in memory and the other on disk. The following is a table of comparisons carried out by Snapp. It will be seen that the time saving is dramatic even if a disk work file is used.

No. of Strings	Normal Time [secs.]	In Memory [secs.]	Disk [secs.]
250	5.1	.42	2.36
500	20	.98	3.87
1000	75	2.34	7.40
2000	294	5.40	14.30
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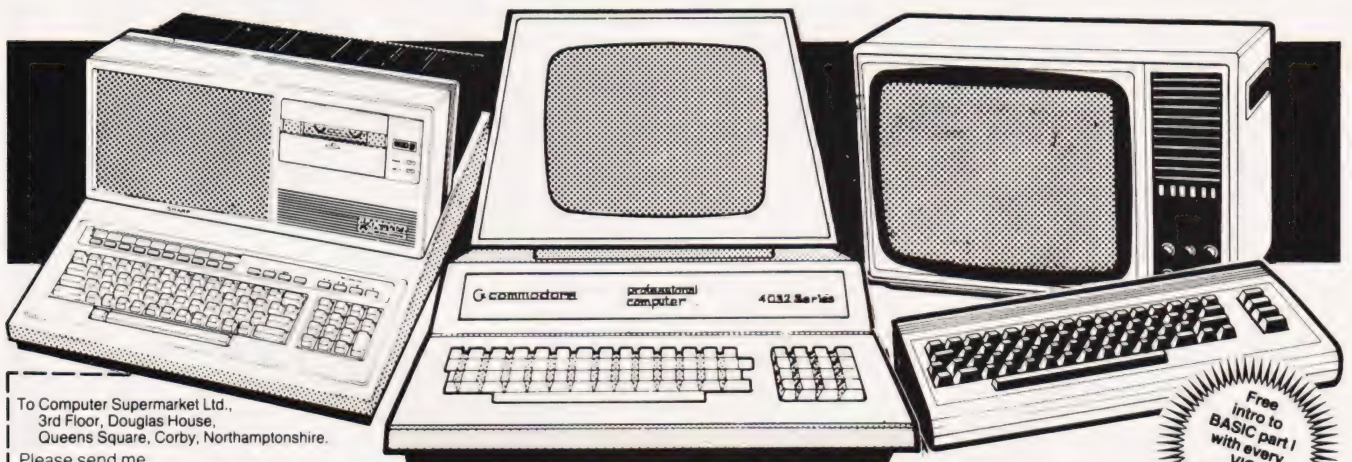
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DISPLAY PLANNER

If you've been cursing your displays why not use the cursor to plan them better? A P Gavriluk

This simple program should be of use to anyone writing programs which use visual displays on the NASCOM 2.

Its function is to allow you to type anything on the screen, except @, and the program will give you the Hex and decimal value of the current cursor position. This will enable you to type the display onto the screen, manipulate it to give the best format, and then pass the cursor over it reading off the values as you go.

The Program

The program was written for the NASCOM 2 and uses both the monitor and the BASIC. Although it is relocatable the best position is OE00 where it is out of the way of

both BASIC and the monitor yet still leaves room for other user routines.

To run the program, BASIC must be started and then the routine executed. At this point the cursor

should be present in the middle of the screen. Pressing any key other than @ should output the current location, pressing @ will return to the monitor.

The program itself makes use of various monitor and BASIC routines and is really just a series of calls. The only point worth note is the call to F9AD which is a BASIC Hex-to-decimal conversion; the number to be converted must be in the HL register at this point.

Program Listing

0E00 21 DF 09		LD HL,09DF	INITIALISE
0E03 22 29 0C	START	LD (0C29),HL	
0E06 DF 7B		SCAL 7B	BLINK
0E08 FE 40		CP 40	CHAR=@?
0E0A 20 02		JR NZ MOVE	
0E0C DF 5B		SCAL 5B	TO NAS-SYS
0E0E F7	MOVE	RST 30	OUT A
0E0F 2A 29 0C		LD HL,(0C29)	GET LOCN
0E12 E5		PUSH HL	SAVE IT
0E13 E5		PUSH HL	
0E14 21 0A 08		LD HL,080A	PUT CURSOR
0E17 22 29 0C		LD (0C29),HL	TO TOP LEFT
0E1A E1		POP HL	RESTORE LOCN
0E1B DF 66		SCAL 66	OUT HL
0E1D CD AD F9		CALL F9AD	CALL BASIC
0E20 E1		POP HL	
0E21 18 E0		JR START	AGAIN

TWO FOR ONE

A couple of programs for Sinclair's ZX81 give you the chance to attempt the Grand Slalom or bomb your favourite city. Mark R Harrison

This program demonstrates two of the ZX81's system variables called FRAMES and DF-CC. The length of time that the skier lasts is calculated by using FRAMES. The value stored in FRAMES is decremented by 1 every time the television screen is scanned and, in the UK, this happens fifty times every second. By presetting FRAMES with a known initial value, the length of time can be obtained by comparing this initial value with the actual value of FRAMES as done in line 70. By subtracting the two values, the number of times the screen was scanned is obtained and by dividing by fifty, this gives the time in seconds.

The obstacles that the skier must negotiate are printed on line 16 of the screen in a random position of up to four columns either side of the skier. They are made to move towards the skier by SCROLLing the display up two lines. To see if the skier has been hit by an obstacle,

the skier's PRINT position is set up as in line 40. DF-CC contains the address of the PRINT position. By PEEKing the address stored in DF-CC, the position that the skier is to be printed on can be checked to see if an obstacle is present. If not, the skier can be printed and the pro-

```

5  RAND
10  LET B = 0
15  LET Z = 15
20  CLS
25  POKE 16437,255
30  POKE 16436,255
35  SCROLL
40  SCROLL
45  PRINT AT 0, Z;
50  IF PEEK (256 * PEEK 16399 + PEEK 16398) = 52
    THEN GOTO 70
55  PRINT "V"; AT 16,Z - 4 + RND * 9; "0"
60  LET Z = Z + (INKEY$ = "M" AND Z < = 25)
    (INKEY$ = "N" AND Z > = 5)
65  GOTO 35
70  LET T = INT ((65535 - PEEK 16436 - 256 * PEEK
    16437)/50)
75  IF T > B THEN LET B = T
80  PRINT AT 16, 0; "TIME "; T, "BEST TIME "; B
85  INPUT Q$
90  IF Q$ = "" THEN GOTO 15

```

gram can continue otherwise the time that the skier lasted is calculated and displayed on the screen.

System Variable	Adresses
DF-CC	16398/9
FRAMES	16436/7

Game Plan

The object of the game is to control a skier and avoid as many obstacles as possible. The two control keys are those with < and > printed on them.

When a skier hits an obstacle, the length of time that he lasted for is displayed along with the best time obtained.

To play again, press NEWLINE or to return to command mode press any character followed by NEWLINE.

The object of the game is to completely destroy a group of buildings. Your aircraft will take as many sweeps over the building as required but each time the aircraft will be at a slightly lower altitude. To release a bomb press key 'B'. On each sweep you are limited to two bombs. It is important to bomb the taller buildings first because the aircraft will be destroyed if it hits a building.

The program illustrates the use of the ZX81's system variable called DF-CC (address 16398/9) which contains the address in the display file of the PRINT position. The main difficulty with the program is to detect if the aircraft has hit a building. The aircraft is displayed on the screen by PLOT X,Y where X and Y are controlled by two FOR loops. Before the aircraft is displayed on the screen the PRINT position is set to where the aircraft will be PLOTed by PRINT (43 - Y)/2, X/2; . The contents of the address which is stored in DF-CC is now the CODE of the character that the aircraft will be PLOTed on. This value is found in line 60 and providing the aircraft has not hit a building this character will be a space (CODE 0)

or a NEWLINE (CODE 118).

Line 75 checks to see if a bomb has been dropped and that both bombs have not been used. If a bomb is dropped, the buildings below are demolished by UNPLOTing the squares which are in the path of the bomb.

To make the task of the bomber harder, the number of bombs for each sweep may be reduced to 1 by amending line 45 to LET B = 1 or by making the initial height of the aircraft lower by reducing the initial value of the control variable in line 40.

```

5  RAND
10  CLS
15  FOR X = 0 TO 15
20  FOR Y = 16 TO 3 + RND * 12 STEP - 1
25  PRINT AT Y, X; "■"
30  NEXT Y
35  NEXT X
40  FOR Y = 39 TO 13 STEP - 1
45  LET B = 2
50  FOR X = 0 TO 31
55  PRINT AT (43 - Y)/2, X/2;
60  LET P = PEEK (256 * PEEK 16399 + PEEK 16398)
65  IF P <> 0 AND P <> 118 THEN GOTO 115
70  PLOT X, Y
75  IF INKEY$ <> "B" OR B = 0 THEN GOTO 100
80  FOR I = Y - 1 TO 11 STEP - 1
85  UNPLOT X, I
90  NEXT I
95  LET B = B - 1
100 UNPLOT X, Y
105 NEXT X
110 NEXT Y
115 INPUT Q$
120 IF Q$ = "" THEN GOTO 10

```

ATOM SAVER

If you've ever wanted to re-run part of a program once it has been stopped then you need this variable saver. S Draper

The routine given here will, hopefully, be of use to people who wish to stop a program at some point and then continue it with the same variable values at a later time. It can also be used to transfer variables from one program to another.

On the ATOM this could be done by using the PUT and GET instructions, but this would be slow if all the variables were required.

The following routine may be saved as a machine code file and thus take up only 58 bytes of memory. It makes use of the OSLOAD and OSSAVE system commands to save the variable space as a file. Note, however, that this routine will not save arrays. The command to actually save the variables is LINK Z.

```

2000 DIMP(-1);X=P
2010 [
2020 LDX@#90;STA#80;LDA@0;STA#91;
      STA#94;LDA@13
2030 STA#81;LDA@128;STA#90;JMP#F96E
2040 ]

```

The following routine will restore the saved file into the variable space by the command LINK X. Note that both routines begin with DIMP(-1) and if both are to be used in the same program one of these must be changed to avoid one routine being assembled over the other.

```

1000 DIMP(-1);Z=P
1010 [
1020 LDX@176;STX#80;LDA@128;STA#90;
      LDA@0;STA#91
1030 LDA@13;STA#81;LDA@3;STA#93;
      STA#97;STA#99
1040 LDA@#21;STA#92;STA#96;LDA@#8D;STA#98
1050 JMP#FFDD
1060 ]

```


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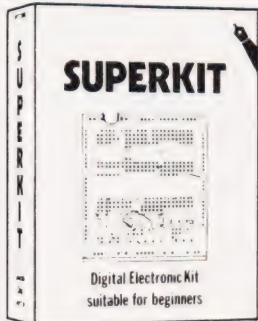


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OK, you've bought your computer and learnt to program it. Now you want to expand and the first item on many people's lists is a printer... but is the choice really that simple?

About a week ago I made my second most important computing purchase — I bought a printer. Ever since I got the hang of programming I couldn't help noticing that if the beast was to be used for anything serious, a printer would be required. But, like all expensive purchases, the acquisition of a printer had to take its place in life's list of priorities.

In order to justify reaching the number one position in that list a real need had to be established. However, as my programming improved, more and more applications arose until the lack of a printer became a definite obstacle to using the computer for business.

The State Of Play

This, then, was the situation:

- 1) I owned a Sharp MZ80-K
- 2) I was far from rich
- 3) I was not a hardware expert
- 4) I was thinking of changing systems at a later date
- 5) I wanted an easy life!

The foregoing meant that I was looking for a printer that I could afford (for 'afford' read 'cheap'). That, in turn, meant a compromise on both quality and speed along with the immediate dismissal of those printers using special paper. That's not to say that printers using special paper are no good, it's just that I envisaged using large quantities of paper and, therefore, that kind of printer wouldn't make economic sense.

The fact that I owned an MZ80-K also had more than a little influence on my decisions. To cut a long story short, my short list consisted of Sharp's own printer, the Roxburgh RX8000 and the Epson MX80F/T. Sharp's offering was dismissed on two counts; firstly when I changed my system it was possible that I wouldn't choose another Sharp. Secondly, as well as the actual cost of the printer was the interface box which added another £90 or so to the price.

After checking around the rest of the printer market I finally opted for the Epson, a device I felt offered the widest dealer network and support. It also appears to be the most adaptable which is important if you

have to keep one eye firmly fixed on your next purchase.

Doing The Deal

The next stage was to 'phone around looking for a deal. This is necessary because the printer market is so competitive and dealers are reluctant to publish prices.

I finally purchased the printer from Sharpsoft in London, having dealt with them before. I won't disclose the price I paid but it was certainly competitive and they are near enough to be able to return the printer if service is needed.

The big day arrived at last, the printer had arrived and I'd set aside a whole day from my business to play with the new toy... and I'm glad I did! As I unpacked the printer the first thing I encountered was a small book. 'What's this' I remember thinking, '... after all, it's only a printer.' I was later to find out!

With the printer successfully extracted from its sturdy womb, a number of jobs were required before the moment of printout could begin. As I had purchased a non-standard interface I was given the dubious honour of installing it. The single PCB fitted neatly into the space inside the printer where interface boards are meant to go, but a 20 minute search of the garage was necessary to locate some suitable self-tapping screws.

After fitting the interface I began to look for the DIP switches referred to in the text, but to no avail. Referring to the manual I discovered that these are located directly under the interface board so recently installed... Sigh!

Following the reaction to a feature we recently published called 'The Teacher's Tale', we are throwing open a page a month for comment and opinion on the micro industry in general. Submissions for this feature should be between 1500 and 2000 words in length and a flat fee of £25 will be paid on publication for any material we use.

Options expressed on this page are those of the author and are not necessarily endorsed by the Editor.

The Soft Solution

The printer is provided with a tape to drive the printer and this must be patched in to the BASIC tape to ensure that the printer receives commands it can understand. Without this software the printer can only be used in what is described as 'TRS80' mode; this requires re-setting of the switches and, on my Sharp, means that the printer cannot be controlled or lower case letters produced.

I have laboured this last point because I have a vision of some poor user leaving the shop with his new pride and joy under his arm, only to be disappointed by it printing page after page of garbage when he gets it home. For those of you who are into machine code or systems programming this would probably represent a challenge, for the rest of us who have specific functions ready and waiting, it just represents a waste of time.

In Conclusion

By way of summary I would like to offer a list of the pitfalls encountered when you consider buying a printer while still keeping an eye to the future.

- 1) You may have to accept that you may not have full use of the graphics available on your machine.
- 2) It is more than possible that the printer will not interpret some of the control codes.
- 3) Ensure that the printer you select can be interfaced to your computer.
- 4) Check whether any extra software will be needed for your system to drive the printer; if it is, are you capable of writing it?
- 5) Remember that the extra cost of special paper could make a cheaper printer uneconomic in the long run.
- 6) If the print head is rated as a consumable, ie it wears out, how often might it need replacing and how much will it cost?
- 7) It is also worth checking that the paper sizes and ribbon types are generally available and not single-sourced.

I must go now, I'm running out of paper. I must go now I'm running I must go I must go Running I must go paper out.

Don't let its size fool you.
If anything NewBrain is like the Tardis.

It may look small on the outside, but inside there's an awful lot going on.

It's got the kind of features you'd expect from one of the really big business micros, but at a price of under £200 excluding VAT it won't give you any sleepless nights.

However, let the facts speak for themselves.

You get what you don't pay for.
NewBrain comes with 24K ROM and 32K RAM, most competitors expect you to make do with 16K RAM.

What's more you can expand all the way up to 2 Mbytes, a figure that wouldn't look out of place on a machine costing ten times as much.

We've also given you the choice of 256, 320, 512 and 640 x 250 screen resolution, whereas most only offer a maximum of 256 x 192.

Big enough for your business.
Although NewBrain is as easy as ABC to use (and child's-play to learn to use) this doesn't mean it's a toy.

Far from it.

It comes with ENHANCED ANSI BASIC, which should give you plenty to get your teeth into.

And it'll also take CP/M® so it speaks the same language as all the big business micros, and feels perfectly at home with their software.

NO OTHER MICRO HAS THIS MUCH POWER IN THIS MUCH SIZE FOR THIS MUCH MONEY.



So as a business machine it really comes into its own.

The video allows 40 or 80 characters per line with 25 or 30 lines per page, giving a very professional 2000 or 2400 characters display in all on TV and/or monitor. And the keyboard is full-sized so even if you're all fingers and thumbs you'll still be able to get to grips with NewBrain's excellent editing capabilities.

When it comes to business graphics, things couldn't be easier. With software capabilities that can handle graphs, charts and computer drawings you'll soon be up to things that used to be strictly for the big league.

Answers a growing need.

Although NewBrain, with its optional onboard display, is a truly portable micro, that doesn't stop it becoming the basis of a very powerful system.

The Store Expansion Modules come in packages containing 64K, 128K, 256K or 512K of RAM. So, hook up four of the 512K modules to your machine and you've got 2 Mbytes to play with. Another feature that'll come as a surprise are the two onboard V24 interfaces.

With the aid of the multiple V24 module this allows you to run up to 32 machines at once, all on the same peripherals, saving you a fortune on extras.

The range of peripherals on offer include dot matrix and daisy wheel printers, 9" 12" and 24" monitors plus 5¼" floppy disk drives (100 Kbytes and 1 Mbyte) and 5¼" Winchester drive (6-18 Mbytes).

As we said, this isn't a toy.

It doesn't stop here.

Here are a couple of extras that deserve a special mention.

The first, the Battery Module, means you won't be tied to a 13 amp socket. And, even more importantly, it means you don't have to worry about mains fluctuations wreaking havoc with your programs.

The ROM buffer module gives you a freedom of another sort.

Freedom to expand in a big way. It gives you additional ROM slots, for system software upgrades such as the Z80 Assembler and COMAL, 2 additional V24 ports, analogue ports and parallel ports.

From now on the sky's the limit.

Software that's hard to beat.

A lot of features you'd expect to find on software are actually built into NewBrain so you don't need to worry about screen editing, maths, BASIC and graphics.

However, if you're feeling practical you can always tackle household management, statistics and educational packages. And because NewBrain isn't all work and no play, there's the usual range of mind-bending games to while away spare time.

Waste no more time.

To get hold of NewBrain you need go no further than the coupon at the bottom of the page.

With your order we'll include a hefty instruction manual so you'll know where to start, and a list of peripherals, expansion modules, and software so you'll know where to go next.

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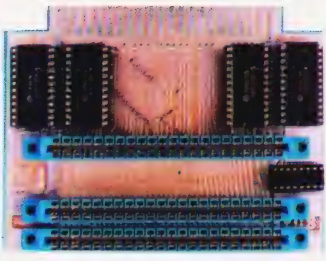
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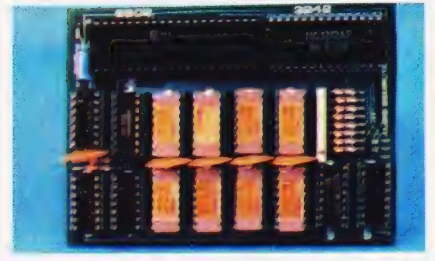
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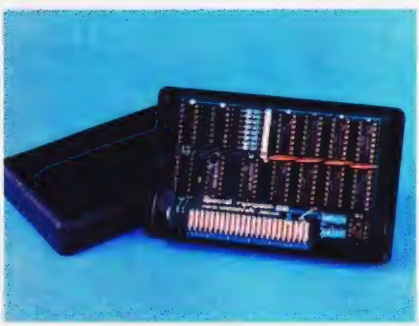
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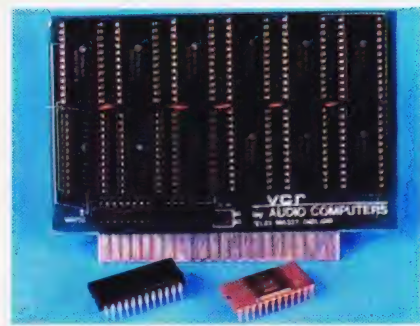
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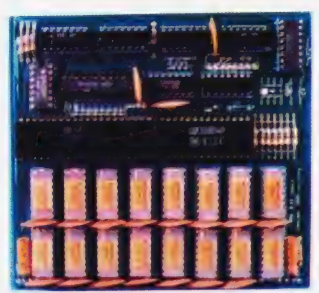
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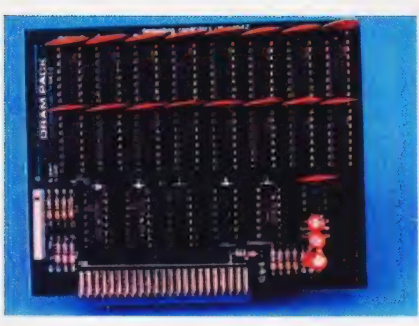
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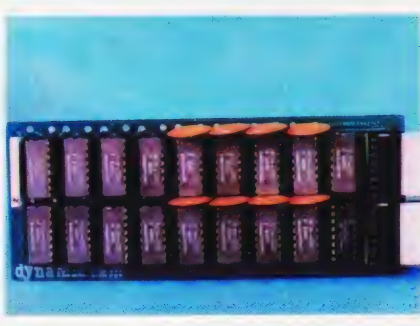
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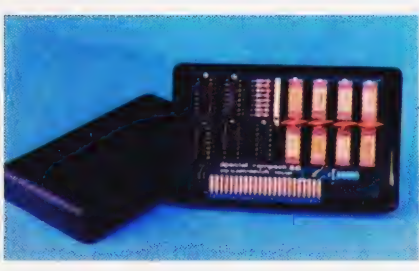
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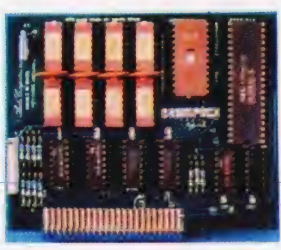
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tion into a character displayed on the screen.

A TV picture is built up from a series of lines and each row of characters requires a number of lines. Each character is formed from a number of dots which may be turned on or off. In this respect the BBC Micro is no different from the rest and uses eight lines of eight dots for

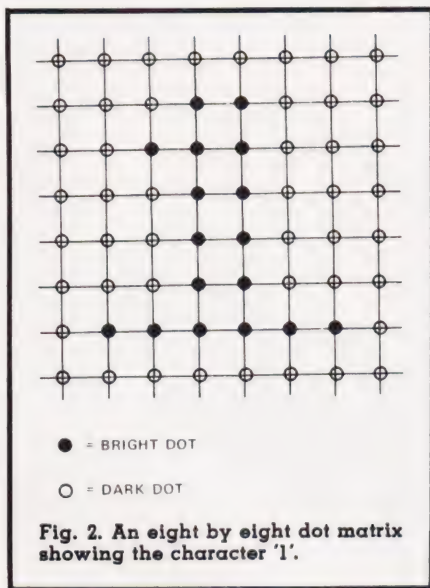


Fig. 2. An eight by eight dot matrix showing the character '1'.

each character (see Fig. 2). However, other micros produce this pattern of dots on the screen by using an extra chunk of memory that is accessible only to the video display electronics. This extra memory is normally called a 'character generator' but it is nothing more than a ROM (Read Only Memory) containing the information concerning which dots should be off or on to form the image of a particular character. It is because this ROM memory is available only to the display electronics that it is normally not counted as part of the computer's memory. If you want to know how much memory is involved in a character generator, all you have to do is multiply the total number of dots used to make up a character by the total number of possible characters and divide by eight (this is because the ROM has to store the dot pattern of every character that can be displayed and each dot requires one bit). For the eight by eight array of dots used by the BBC Micro, a ROM to generate the character set would have to be 2K in size.

The usual method of displaying characters on a screen using a character generator is simply to use the ASCII code stored in the com-

puter's memory as an 'address' to select the location in the ROM that stores the dot pattern for that character (see Fig. 3). Instead of using this traditional approach to video display, the BBC Micro dispenses with a character generator ROM and stores the dot pattern of the character to be displayed in RAM. The disadvantage of this method is that each screen location needs enough RAM

screen. A second advantage is that the character set is not restricted to whatever is stored in the character generator ROM thus allowing you to define new characters.

These two advantages give the BBC Micro a freedom in handling both graphics and characters difficult to match using any other method. For comparison, the Apple uses a bit mapped display for its high resolution graphics but uses a

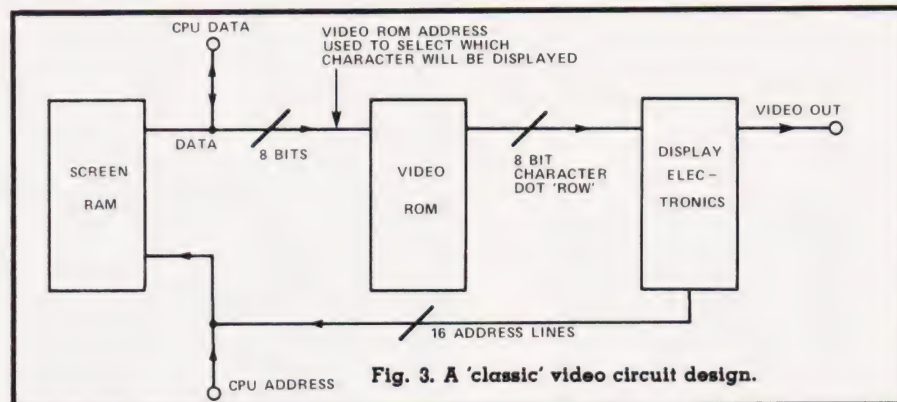


Fig. 3. A 'classic' video circuit design.

to store all the dots for a single character — in the case of the BBC Micro this amounts to eight bytes per screen location. This means that in MODE 4, for example, with 32 lines of 40 characters, the total RAM required is 32 times 40 times 8, ie 10K bytes, and all this RAM is taken from the user RAM that you might have used to store programs and data.

In other words, the BBC Micro uses eight times the amount of screen RAM for a given screen size — because it stores an eight bit code instead. The method the BBC Micro uses is often called a 'bit mapped display' because every bit in the screen RAM corresponds to a dot on the video screen.

What Advantage?

Given the extra memory that the BBC Micro has to use to produce its display you might be wondering what the advantages are. The main advantage is that you can produce high resolution graphics and text characters using the same hardware. Since every dot on the screen corresponds to a bit in the memory location, instead of storing the dot pattern corresponding to a character, you can change individual bits in the memory to produce lines and other shapes. Also, because the same basic method is used to display characters and to produce high resolution graphics, you can mix both *anywhere* on the

standard character generator for its text modes and so has difficulty in freely mixing text and graphics without extra software (shape tables). On the other hand, the PET uses a character generator for both text and graphics and so can mix them freely but the range of graphics is limited to those already defined in its ROM.

What all this means to the programmer is that, unlike machines such as the PET where POKing a byte into a memory location causes a complete character to appear on the screen, POKing a byte to the BBC Micro's display memory causes a pattern of dots on a single line to appear. All that we need to know now is how each memory location corresponds to a screen position and the best way to discover this is via a small test program.

If we start at the lowest screen address and POKe a byte consisting of all 'ones' then a short line of dots will appear somewhere on the screen. If the BBC Micro uses a fairly normal screen memory map, the line should appear in either the top left-hand or bottom right-hand corner. Before we can try this little experiment, however, it is necessary to look at the way the BBC BASIC allows memory to be POKed. Although I have been using the term POKe to describe storing some data in a given memory location, this is not a term that BBC BASIC uses. To POKe a byte into memory location

BBC PROGRAMMING

at 'address', the BBC Micro uses:

```
?address=byte
```

and the '?' isn't a mistake. It means 'treat the number following as an address' (familiar ground for ATOM users but a little strange to the rest of us). The address and byte used in this expression can be variables or constants. If constants are used then it is useful to know that you can specify a hexadecimal constant by using '&'. For example &01 is 1, &0F is 15 and so on.

Practical Experiments

Now we know how to alter a memory location, we can resume the examination of the screen. If you run the following program:

```
10 MODE 4
20 ?HIMEM=&FF
30 GOTO 20
```



You should now see a short horizontal line in the top left-hand corner. If you don't then it's possible that it's just off part of the screen your TV displays and a slight adjustment of the controls should make the line visible. The program works by first selecting MODE 4 and then (in line 20) storing the Hex value FF in the memory location whose address is stored in HIMEM. The variable HIMEM stores the address of the first screen location in any mode and FF in binary is eight 1s — so producing a row of eight dots.

We now know that the first (lowest) screen address corresponds to the top left-hand corner. To find out how the rest of the screen memory map goes, try the following program.

```
10 MODE 4
20 FOR I=0 TO 7
30 ?(HIMEM+I)=&FF
40 NEXT I
50 GOTO 50
```



This stores the Hex value FF in eight consecutive memory locations. What is surprising about the result of this program is that instead of producing a thin line eight characters

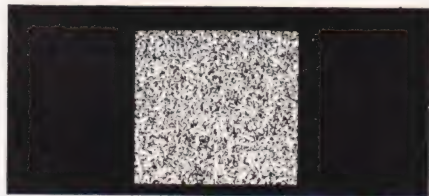
long across the top of the screen, it actually displays a solid block about the same size as a normal character. The screen memory map of the the BBC Micro is such that the first eight memory locations form the dot matrix for the first character. The next eight form the dot matrix for the character to the right of the first and so on to the end of a line. To see the screen memory map in action, try the following:

```
10 MODE 4
20 I=0
30 ?(HIMEM+I)=&FF
40 I=I+1
50 FOR J=1 TO 50
60 NEXT J
70 GOTO 30
```



You should see the screen fill up character position by character position. You can use this program to explore the possibilities of POKEing graphics data directly onto the screen. For example, illustrating that things other than solid lines can be POKEd, try altering line 30 to:

```
30 ?(HIMEM+I)=RND(255)
```



and removing the delay loop formed by lines 50 and 60.

Using this information we can work out a simple equation that will give the address of any screen location:

$$\text{address} = \text{HIMEM} + (\text{X} + \text{Y} * 40) * 8 + \text{N}$$

This expression gives the address of the Nth line making up the character at the screen location X,Y (N,X and Y all start from zero in the top left-hand corner).

Colourful Expansion

The reason why the previous section considered the memory map for MODE 4 is that it is a two-colour mode; this means that each point in a character can only be one of two fixed colours and so can be represented by a single bit. If a

MODE uses more than two colours — sixteen for example — then you need more than one bit to represent each point on the screen. It's a little difficult to explain how many you need in general but two bits can represent up to four colours, three can represent eight and four can represent sixteen. The question is — how are the extra bits organised in the memory map of the other modes?

The answer is that the fundamental memory map outlined for MODE 4 is used for all the other modes except that each point on the screen now corresponds to a small group of bits in each memory location. For example, in MODE 4 a memory location holding eight bits gave rise to eight dots but in MODE 5 (a four-colour mode), the same memory location only gives rise to **four** dots. In this case each group of two bits determines which of the four colours a point will be (see Fig. 4).

The best way to investigate the memory maps of the other graphics modes is to use the programs given in the last section but change line 10 to give the required mode. In MODE 5, as each block of eight memory locations now corresponds to only eight rows of four dots and each character still needs eight rows of eight dots to be displayed. It should be obvious that the storage of a single character involves two such blocks.

If all this seems a little complicated then all I can say is that compared to the way other computers work *it is*. But if you want to have the sort of freedom of action that the BBC Micro allows, there is no other way of doing it! In practice, the use of direct memory mapped graphics is limited to either MODE 4 (where it is easy) or involves assembler (where everything is more difficult!!). Seriously though, POKEing the screen is not as useful on the BBC Micro as on other machines — partly because it is more difficult except in two-colour modes and partly because the BASIC provides all sorts of features that make it unnecessary. What is more important though is that a knowledge of the screen memory map allows you to find out quickly what is stored at any screen location.

PEEKing The Screen

This brings us to the topic of PEEKing the screen to see which character is stored at any particular location. This is easy on machines

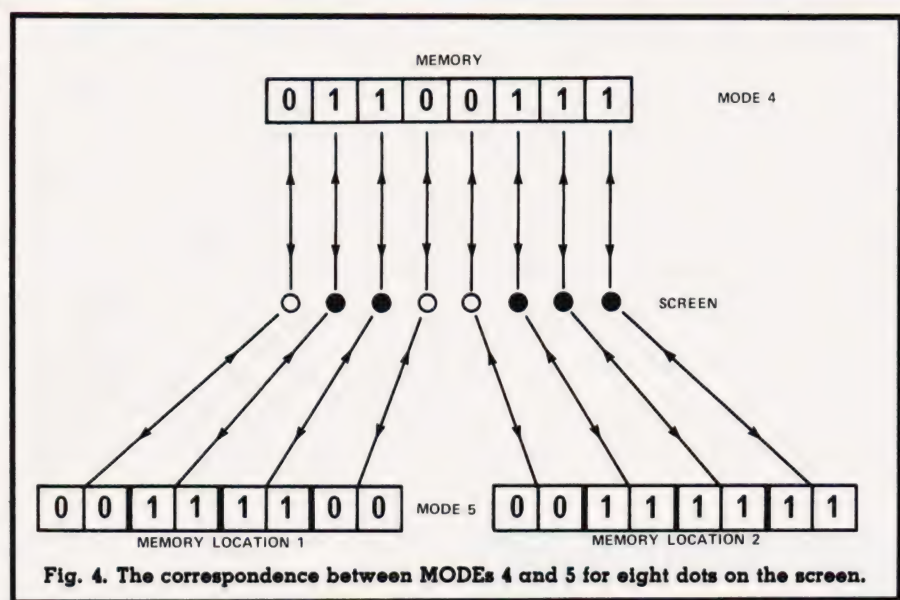


Fig. 4. The correspondence between MODES 4 and 5 for eight dots on the screen.

such as the PET — all you have to do is to PEEK the screen location and this returns the ASCII code of the character stored at that position. For the BBC Micro things are not quite as easy.

The first problem is that PEEKing a screen location in a two-colour mode returns the dot pattern of a row of the character stored at the location. This is not as useful as the ASCII code because in general it is not enough to identify the character — for example, it is possible for two characters to have the same dot pattern in every row except one! The second problem is that for the modes which use more than two colours, even a single row of dots from a character is difficult to obtain without a number of PEEKs and quite a bit of logic.

This might make you think that screen PEEKs are not worth the trouble on the BBC machine. However, for MODE 4, things are easier than they look. The general problem of deciding what character is stored at a screen location is difficult even in MODE 4 but in most graphics-based applications this is more than we want to do. Instead of identifying which character from the set of all possible characters is present, it is usually enough to decide which one of two or three characters is there. For example, if you are using 'O' to represent one type of player and 'X' to represent another then we only have to discover if the character stored at a location is one of blank, O or X. This is a much easier problem as it should be possible to find a row of dots different in each character. If this *is* possible then you can tell the three characters

apart by PEEKing that one row! in the case of blank, X and O, any row will distinguish them but row three corresponds to 0, 24 and 102 respectively.

The BBC Micro uses the '?' instead of PEEK as well as POKE. If you want to PEEK a particular screen location then all you have to do is:

```
?address
```

This will return the contents of the memory location at 'address'. For example:

```
A=?2000
```

stores the contents of memory location 2000 in A. Notice that the '?' represents a POKE if it is on the left of an equals sign and a PEEK if on the right. Now that we know how to PEEK a memory location and we know the screen memory map for MODE 4, we can write a function that will return the contents of a particular row of a screen location:

```
100 DEF FNS(X,Y,N)=HIMEM+(X+Y*40)*8+N
```

FNS will return the address of the screen location corresponding to character position X,Y and the Nth row of the character.

To give an example of how to use FNS, the program below will print a character on the screen at 20,10 and will then print the value of the dot pattern making up each row of the character.

```
10 INPUT A$
20 MODE 4
30 PRINT TAB(20,10);A$
40 FOR N=0 TO 7
50 PRINT N,?FNS(20,10,N)
60 NEXT N
70 END
100 DEF FNS(X,Y,N)=HIMEM+(X+40*Y)*8+N
```



This program can also be used to discover how any character is made up — it was used to find out the values of the third row of blank, X and O in the previous example. In practice, the function FNS would be used in IF statements to decide what should be done according to what is stored at a particular location.

Using The MOS To PEEK

There is a way of discovering the ASCII code of the character stored at a screen location but it needs aUSR call to the MOS (Version 1 and later revisions only) and it is slow (about 120 milliseconds per character). However, if speed is not important then you can use the following function:

```
100 DEF FNASC(X,Y)
110 LOCAL C
120 X%=X
130 Y%=Y
140 A%=135
150 C=USR(&FFF4)
160 C=C AND &FFFF
170 C=C DIV &100
180 =C
```

FNASC(X,Y) will return the ASCII code at screen location X,Y and CHR\$(FNASC(X,Y)) will supply the character itself.

The operating system call used in the above function (ie USR(&FFF4)) works by reading the screen memory, assembling the eight bytes representing the character's dot pattern (easy in two-colour modes, not so easy in the rest) and then searching an area of memory in the operating system that is used to generate the dot pattern in the first place. This area of memory is the BBC Micro's equivalent of a character generator. When you PRINT a character to the screen this area of memory — the character table — supplies the dot pattern for

BBC PROGRAMMING

the character. This is fast because the table is organised so that the ASCII code of the character leads straight to the correct pattern. However, going back from the pattern to the ASCII code is slower because it involves finding a match for eight bytes somewhere in the table!

The Trouble With SCROLL

There is one feature of the BBC Micro that is very surprising and can make use of the screen address map very difficult. When you carry out a MODE command, the screen address map is set up as we have discussed and remains unaltered during the running of a program unless that program prints something that causes the screen to scroll. The action of scrolling is such a common sight on VDUs and computers that it is rare to give it a second thought. However, if you try to write a program from first principles to scroll an entire screen, you will realise what a time-consuming manoeuvre it is. Each text line of the screen must be moved up by one

line. The bottom line is cleared and the top line is lost.

In the BBC Micro's case, this screen shift, if done by software for MODE 4, would need 10K bytes of storage to be rearranged — slow to say the least! To overcome this speed problem, scrolling is carried out by hardware which in effect alters the screen memory map so that the memory locations correspond to screen positions one higher. The memory corresponding to the old top line is cleared and is made to correspond to the new bottom line — ie following a single scroll, POKEing data into memory that was the top line produces output on the bottom line. Of course this 're-mapping' of the screen makes a nonsense of the screen mapping functions given earlier! However, the solution is simple — either avoid scrolling the screen following a MODE command or adjust the functions to take account of any scrolling.

To take account of scrolling, it is necessary to keep a count of the number of times the screen has scrolled since the last MODE command. If the scroll count is kept in

SC then the following version of FNS will work (for MODE 4):

```
100 DEF FNS(X,Y,N)
110 YT=Y+SC
120 YT=YT-INT(ABS(YT)/32)*32
130 =HMEM+(X+Y*40)*8+N
```

Notice that YT and SC are global variables and are thus accessible to the main program. Luckily, it is not often that the need to scroll the screen occurs in the same situation as the need to use POKE or PEEK graphics.

Conclusion

My final comment must involve a small warning. Acorn are at pains to point out all the way through the BBC Micro's manual that non-standard ways of doing I/O are to be avoided if you want to use your software with any second processors connected through the 'Tube'. This is a valid point but then again, if your program works well on a standard BBC machine and you have no plans for using additional processors, you may find it fun to experiment.

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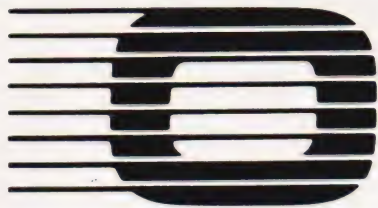
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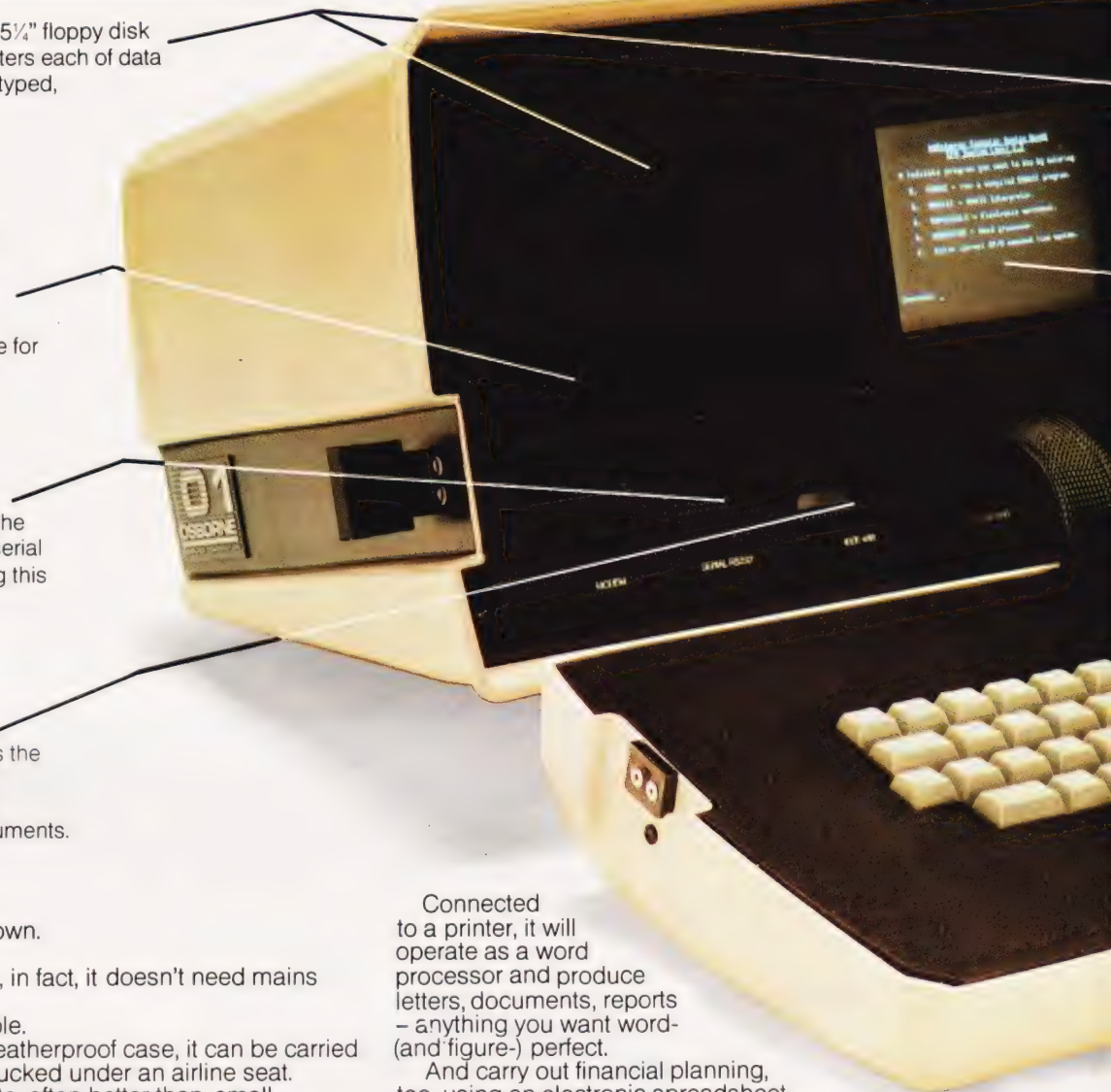
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Once more the Editor climbs onto the soapbox and passes comment upon the world in general. Well, PEEKing, POKEing and The Valley actually but who's counting!

It is getting difficult to find new and interesting topics among the postbag these days. Just about the only two topics that appear to interest people at the moment are The Valley, of which more in a moment, and the BBC Micro.

Of Mysterious Commands

However, the following missive from Mr F Jackson of Castle Bromwich brought a ray of light into the relative darkness.

I am a newcomer to computing but having read through the magazines for the last 12 months I finally decided to purchase a Sharp MZ-80K. Thumbing through past copies of Computing Today for programs, I find that some of them use PEEK and POKE statements. Unfortunately, the manual supplied with the MZ-80K is completely without proper explanation of these commands except to say that it can be dangerous to use POKE commands carelessly and that damage could well occur.

Could this damage be permanent and would it involve the replacement of ICs? As this has put me off using programs which involve PEEK and POKE I wonder if you could help me with an explanation.

After many years in the business I think I can safely say that these two BASIC statements have caused more trouble than the rest put together. Indeed, a whole mystique seems to have built up around them which is often exploited — those who understand the commands having a sort of 'status'. Put simply there is nothing you can do in a program which will cause permanent damage to the system. All the command POKE does is to change the contents of one single location in memory; indeed if you try to change a location which is in ROM rather than RAM nothing will happen at all! The main use of the POKE statement is in graphics games where it is used to change the characters on the screen almost instantaneously.

The reverse command, PEEK, looks at a location in memory and brings back the value stored there — it actually brings back a copy and leaves the contents unchanged. This

command is used, again often in games, to inspect some portion of the screen to see if your missile has hit an alien... or something similar.

Now, probably the best way to find out about the way these functions work (on your Sharp) is to try POKEing values between 1 and 255 to locations between 53248 and 54247. The results should be that graphics blocks appear in various positions on the screen. You should be warned at this point that if you go POKEing around outside the screen address area funny things can happen — the machine can go all dumb on you! All you have to do is turn it off and then back on again. OK, the program will have disappeared but you did save it on tape...didn't you?

We will be bringing you a feature on the arts of PEEK and POKE in the very near future but until then just do what the rest of us do, try it out and have fun!

Venturing Forth

Those of you who thought the headline was a subtle intro to a piece on the virtues of a certain programming language are obviously not into the world of Adventure! It appears that our contribution to the world of fantasy gaming has caused more than a little interest judging by the amount of mail we have been getting over the last couple of months. I trust that we've managed to sort out your various queries and the two bugs which slipped through my fingers (well *somebody* had to type it into the word processor) are by now well documented.

The single most encouraging sign of The Valley's success is that a large number of you have taken the plunge and gone ahead with conversions to a wide variety of systems. We currently have versions for the BBC Micro, Sorcerer, UK101, Apple, Atari and even the ZX81 on test to see if they match our original versions. If they do, we hope to be able to offer them under our CT Software service which will make the program available on most of the popular systems.

Many people have commented that the game can be expanded and in some ways improved by this or that alteration. We know! It was a conscious decision to publish a 16K

version, the original development program occupied well over 20K with bigger versions still at various points. We will be publishing updates from time to time, starting next month (subject to testing) with a remarkable re-vamp of not just the program but the whole scenario as well. We have had criticism, one would hardly expect to undertake a project of this nature without it, but the 11 months of effort by the team has, in the main, paid off handsomely. We didn't name the writers at the time but, as several of you have asked, the team comprised Peter Freebrey, Peter Green and Roger Munford, with considerable assistance in the early game design from Ron Harris. The number of man hours invested probably runs into thousands but it was worth every minute. Next year... well that would really be telling!

Help Required

We are just about to start an expansion programme in the use of our programming standards and your views on one or two points would be appreciated. Whilst the codes are undoubtedly successful — one book publisher is basing a whole series of programming books around them — they might have some limitations. If you think that they fall short of what you'd like to see, first remember that no-one else even bothers and then drop a line to me at the magazine and we'll see what we can do. The sort of problems we already know about, and have solved, are the representation of VIC graphics which require two shifts and the new BBC Micro's function keys.

This last cry for help is somewhat less serious. Someone has stolen two copies of file magazines from my personal archives. Does anyone out there have spare copies of the first ever issue of Practical Computing (September 1978) or the October 1981 issue of Your Computer? If anyone has copies of these in reasonable condition which they would be willing to part with, please write and let me know — don't send the magazines at this stage. I'm voting for the Arabic method of crime prevention at the next election — cut their hands off and they won't be able to!

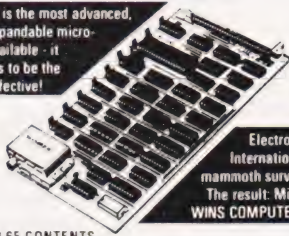
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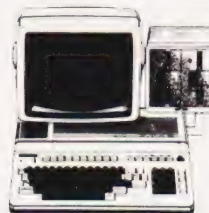
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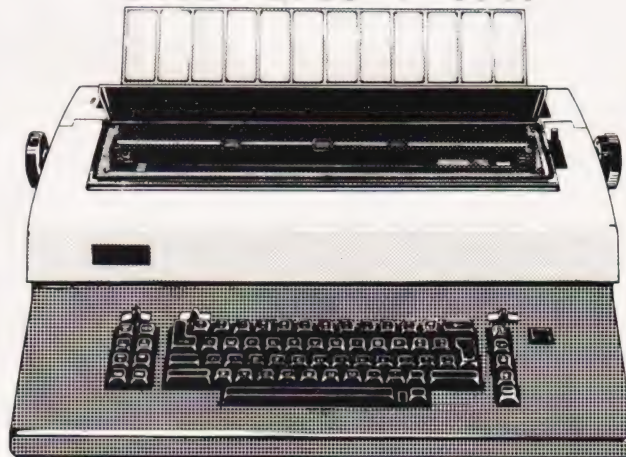
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Target is a game written in Microsoft 10K BASIC and requires 2021 bytes of memory to run.

Using a simple mixture of graphics and ASCII characters for the screen presentation, the game involves shooting at a randomly positioned target in the upper half of the screen from a moving gun turret traversing a horizontal grid line in the lower half of the screen. Below the grid line are printed the totals of 'SHOTS' and 'HITS'; these totals are incremented each time a shot is fired or a hit is made. Figure 1 shows the format.

The game length can be determined by the player selecting the number of shots, either 20, 40, 60 or 80. However, if a wrong input is made the game will automatically finish after 100 shots have been fired.

At the conclusion of the game, the screen scrolls and the various scores, ie 'SHOTS', 'HITS' and 'number of targets presented', are printed on the screen together with a prompt for another game.

Program Breakdown

140-170	Set up the value of P according to number of shots selected. P will be compared later with Y (tens of 'SHOTS') to test for game finish.	370
180	Clears Screen.	380
190-230	Set up titles ('HITS' and 'SHOTS') on screen.	390
240-260	Put initial grid line on screen.	400
270-300	Initialise counts for 'HITS', 'SHOTS' and 'TARGETS'.	410
310-320	Set up random integers for use in 'Target' placement.	420
330	Sets X to maximum value of 'SHOTS' tens.	430
340	Sets up counter for random target positioning.	440
350	Turns graphics on and puts 'Target' in random position on screen.	450
360	Turns graphics off, setting the value of S to 'Target'	

position and incrementing the 'Target' count.

Sets up counter for gun traverse (set for maximum width of the screen, within the limits of the program).

Turns graphics on and prints part of grid line (grid line will be erased by the gun so it has to be renewed).

Prints gun in new position and polls keyboard.

Turns graphics off.

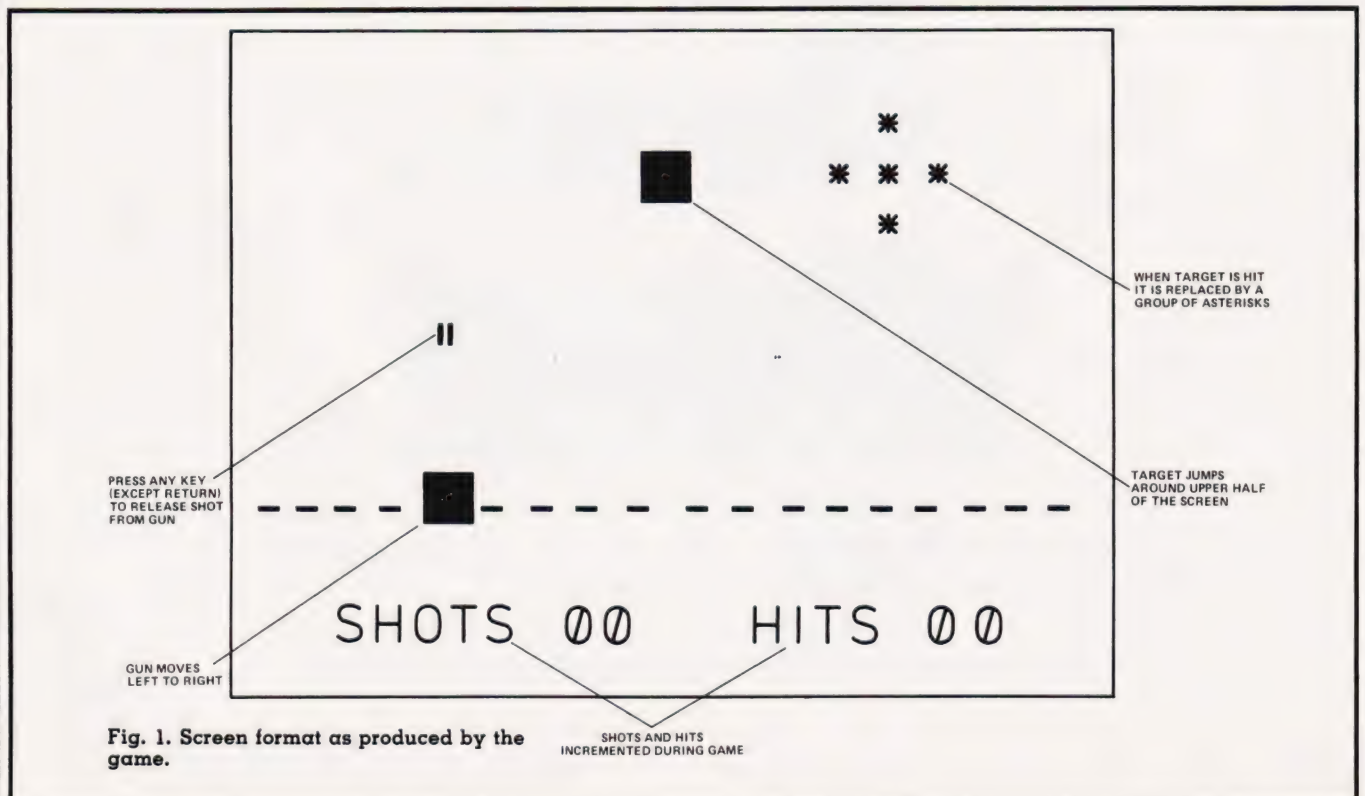
If tens of 'SHOTS' is equal to the value of P then go to 750.

If contents of ICHAR (last keyboard entry) is not equal to the ASCII code for Carriage Return then go to 470.

Repeats from line 380 until gun has moved to limit of screen width (as set by line 370).

Erases last gun and erases target.

Repeats from line 350



	until target position count is complete.	550	Erases 'Bullet' from its final position (if target has not been hit).	700	go to 750.
460	Repeats from line 310.				Sets 'SHOTS' units to 0 and puts updated 'SHOTS' units on screen.
470	Sets up counter for 'bullet' positioning.	560	If 'SHOTS' units are 9 then go to 690.	710	Increments 'SHOTS' tens and puts updated 'SHOTS' tens on screen.
480	Turns graphics on and puts stationary gun on screen at point where 'bullet' was fired from.	570	Increments 'SHOTS' count and puts updated count on screen.	720	Sets 'HITS' units to 0 and puts updated 'HITS' units on screen.
490	Turns graphics off.	580	Erases gun from its last position and goes to 430.		Increments 'HITS' tens and puts updated 'HITS' tens on screen.
500	Puts bullets in position relative to count.	590	Sets up count for duration of 'explosion' effect.	730	Sets up next shot (go to 540).
510	If 'Target' position is the same as 'Bullet' position then go to 590.	600-620	Put 'explosion' effect on screen in place of target.	740	Scrolls display 1 line.
520	Erases 'Bullet' from previous position.	630-650	Erase 'explosion' effect.	750	Prints number of targets presented during game.
530	Repeats from line 480 until 'Bullet' position count is complete.	660	If 'HITS' units are 9 then go to 720.	760	Scroll display 5 lines.
540	Places ASCII code for 'Carriage Return' in ICHAR.	670	Increments 'HITS' count and puts updated count on screen.	770-790	Test for another game or for finish.
		680	Sets up next shot (go to 540).	800-870	
		690	If 'SHOTS' tens are 9 then		

Program Listing

```

10 REM TARGET
20 GOSUB 1000
30 PRINT"THIS IS A GAME WHERE THE TARGET"
40 PRINT"JUMPS AROUND THE UPPER HALF OF"
50 PRINT"THE SCREEN, AND THE GUN MOVES"
60 PRINT"FROM LEFT TO RIGHT ON THE LOWER"
70 PRINT"HALF OF THE SCREEN"
80 PRINT"PRESS ANY KEY TO FIRE THE GUN"
90 PRINT"(EXCEPT RETURN)"
100 PRINT: PRINT: PRINT
110 PRINT"HOW MANY SHOTS DO YOU WANT?"
120 PRINT"(ENTER 20,40,60 OR 80)"
130 INPUT F
140 IF F=20 THEN LET P=50
150 IF F=40 THEN LET P=52
160 IF F=60 THEN LET P=54
170 IF F=80 THEN LET P=56
180 GOSUB 1000
190 POKE 1010,72:POKE 1011,73
200 POKE 1012,84:POKE 1013,83
210 POKE 994,83:POKE 995,72
220 POKE 996,79:POKE 997,84
230 POKE 998,83
240 FOR D=0 TO 30
250 POKE 49136,0:POKE(928+D+1),32
260 POKE 49139,0:NEXT D
270 LET Z=48:LET Y=48
280 LET W=48:LET V=48:LET T=0
290 POKE 1000,Y:POKE 1001,Z
300 POKE 1015,V:POKE 1016,W
310 LET M=INT(5+20*RND(5))
320 LET N=INT(20+100*RND(5))
330 LET X=57
340 FOR B=M TO 255 STEP N
350 POKE 49136,0:POKE(544+B),255
360 POKE 49139,0:LET S=544+B:LET T=T+1
370 FOR C=0 TO 30
380 POKE 49136,0:POKE(928+C),32
390 POKE(928+C+1),255:POKE 49138,0
400 POKE 49139,0
410 IF Y=P THEN 750
420 IF PEEK(1)><13 THEN 470
430 NEXT C
440 POKE 959,32:POKE(544+B),32
450 NEXT B
460 GOTO 310
470 FOR E=0 TO 13
480 POKE 49136,0:POKE(928+C+1),255
490 POKE 49139,0
500 POKE((928+C+1)-(E*32)),34
510 IF S=((928+C+1)-(E*32)) THEN 590
520 POKE((928+C+1)-(32*(E-1))),32
530 NEXT E
540 POKE 1,13
550 POKE((928+C+1)-(32*13)),32
560 IF Z=57 THEN 690
570 LET Z=Z+1:POKE 1001,Z
580 POKE(928+C+1),32:GOTO 430
590 FOR F=1 TO 5
600 POKE S,42:POKE(S-1),42
610 POKE(S+1),42:POKE(S-32),42
620 POKE(S+32),42:NEXT F
630 POKE S,32:POKE(S-1),32
640 POKE(S+1),32:POKE(S-32),32
650 POKE(S+32),32
660 IF W=57 THEN 720
670 LET W=W+1:POKE 1016,W
680 GOTO 540
690 IF Y=X THEN 750
700 LET Z=48:POKE 1001,Z
710 LET Y=Y+1:POKE 1000,Y:GOTO 430
720 LET W=48:POKE 1016,W
730 LET V=V+1:POKE 1015,V
740 GOTO 540
750 PRINT
760 PRINT"NUMBER OF TARGETS PRESENTED";T
770 FOR K=1 TO 5
780 PRINT
790 NEXT K
800 PRINT"WANT TO TRY AGAIN(YES/NO)"
810 INPUT A$
820 IF A$="YES" THEN 860
830 GOSUB 1000
840 PRINT"HOPE YOU HAD FUN!!"
850 GOTO 1040
860 GOSUB 1000
870 GOTO 100
1000 FOR J=0 TO 15
1010 PRINT
1020 NEXT J
1030 RETURN
1040 END

```


Sinclair ZX81 Personal Computer the heart of a system that grows with you.

1980 saw a genuine breakthrough – the Sinclair ZX80, world's first complete personal computer for under £100. Not surprisingly, over 50,000 were sold.

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We show you how to add extra commands to your NASCOM's BASIC with this toolkit-type package.

Most BASIC interpreters used in microcomputers are trimmed to fit into 8K of memory. This means that many of the more useful functions of a full BASIC are missing — routines such as RENUMBER, for instance.

The NAS-SYS monitor allows the programmer to add his own input or output routines. The address of a user input routine must be placed in locations 0C7B Hex and 0C7C Hex. This in itself will not achieve anything but, because NAS-SYS uses a table of routine numbers for input and output, we must replace this table of routine numbers for input and output, we must replace this table with our own. The address of the input table must be placed at 0C75/0C76 Hex. To replace all the input routines with our own user routines, the table need only contain the Hex numbers 76 and 00. The Hex number 76 calls the user input routine, the address of which was stored in 0C7B. Having replaced the tables with our own, we then have the problem of deciding what to use for our input routine and how to decode the possible utility keywords. The input routine must, of course, leave any 'normal' lines available to BASIC, with the correct register values set.

Memory Usage

In the Zeap Assembler listing, the program is assembled at 0C80 Hex — but it will work from any allowable start location.

The program makes extensive use of NAS-SYS routines, all called by their routine numbers so that either NAS-SYS 1 or 3 could be used. This cuts down on a few bytes but increases the processing time slightly.

The utility uses some work space, but areas were chosen to be transparent to the programmer. Locations 0800-0809 Hex, the first 10 bytes of the screen locations, are unaffected by a Clear Screen command and are used to store the absolute program addresses. If this area of memory is corrupted then the program will crash.

There are also 12 bytes used from location 1078 Hex, which is part of the BASIC input buffer, but that causes no problems as it is only used during the DUMP routine.

```

0DD0 20 02
0DD1 3E 20
0DD3 32 7A
0DD6 32 80
0DD9 23
0DDA 7E
0DDB 32 79
0DDE 32 7F
0DE1 E5
0DE2 21 78
0DE5 B7
0DE6 CD 23
0DE9 CD 66
0DEC E1
0DED 23
0DEE 23
0DEF 23
0DF0 23
0DF1 23
0DF2 18 BE
0DF4 DF 79
    
```



```

NZ TWOVAR
A "
(PRISTO+2
(PRISTO+8
HL
A (HL)
(PRISTO+1
(PRISTO+7
HL
HL PRISTO
A
$EB23
$E866
HL
HL
HL
HL
HL
HL
OOP
79
    
```

A description of the various sections of the program now follows. The numbers given correspond to the Zeap line numbers.

Setting Up (200-610) — The program clears the screen and sets ARG1 to zero. This is only needed if you have NAS-SYS 3 — if you don't know why, then try missing it out and loading a program from cassette into BASIC.

If you want an EPROM version and you usually program in BASIC, you could replace the section (200-230) with something like this:

```

LD SP $1000 — sets the stack pointer
CALL $000D — calls ST MON to set up NAS-SYS
    
```

You could then adjust the RESET address to start the utility at reset or switch on.

The next section (240-480) determines the present position in memory of the program so that the absolute position of the keyword table, the subroutine address table and the program start can be stored for later use.

A 'false' relative call is made (240) to the instruction which then POPs the return address, ie the present absolute memory address, into the HL register. By adding appropriate offsets, the input table address is loaded into 0C75 Hex and the user input routines into 0C7B

Hex. As previously mentioned, three other values are stored at 0801, 0803 and 0805 Hex. In this section the byte to the left of line 1 of the screen is set to zero. This is to ensure that a zero byte is to the left of each line — the reason for this will become more obvious later.

At the end of the set-up section, the user is asked for a warm or cold start to BASIC. The memory size should be chosen so as not to corrupt the utility if it is in high RAM.

The New Input Routine (630-1440)

— This routine starts with a call to the NAS-SYS 3 repeat keyboard scan. If you have NAS-SYS 1 then the value 7D Hex should be changed to 61 Hex. If a key is pressed, then a check for a Carriage Return is made; if it is found, a check for a keyword is made.

The fiddling with the stack (680-770) is performed to retrieve the code for the character at present under the cursor, just in case it is blanked when Return was pressed. The registers are saved and an appropriate message is printed. The character under the cursor is loaded into the DE register and replaced on screen if necessary. The HL register is then set to the start of the line. This is done by stepping left from the present cursor position until a zero byte is found (950-990).

NASCOM UTILITY

A routine then compares the first few characters on the line with each of the words in a keywords table. The first character of each word has the most significant bit set, the end of the table being marked by an 80 Hex. As the keywords are checked, the BC register is used as a counter and if no match is found, the registers are reset. However, if a match is found then the routine from 1290 is used to pick the correct offset from a look-up table. This is loaded into HL and the offset added. The screen location of the byte after the keyword is saved in the DE register for use in the various routines. The true address of the subroutine is in HL so that a jump to the routine called can be made after the stack is cleared.

The Routines

OLD (1480-1650) — If, after an aborted CLOAD or a mistaken NEW you wish to recover your program, this routine will do the job for you. However, it will not work if the program has been corrupted for any reason (ie a cold start to BASIC).

DEC XXX — After the word DEC, you type the decimal integer you wish to change to hexadecimal. The program uses two routines in the BASIC interpreter. The routine at E836 Hex searches the memory pointed to by HL and if a valid decimal digit is found, the carry flag is set. The routine called at E9A5 Hex then converts the number into Hex in DE. This routine will only convert numbers 0-65529 (0-FFFF Hex) — if you want the other six values, you must write your own conversion routines!

NAS-SYS calls are then used to print the Hex value.

DUMP — After a program run this routine will list the program variables, both number and string, and their current value. It does not list arrays. After each value is printed, you can press any key to continue or Escape (Shift/Enter) to stop the listing.

This section uses the BASIC print routine and requires HL to point to the first byte of the line to be printed. To allow us to make use of the routine (called at EB23 Hex), a false BASIC line is set up from 1078 to 1083 Hex as a mask. This is what is written there:

```
"Z - - =" ; Z - - 00
```

and in the ASCII form:

```
22 5A 20 20 5D 22 5B 5A 20 20 00
```

The BASIC work space is then searched for the variables, and as they are found, their 'names' are copied on to the mask. Thus, if the first variable was AZ\$ the mask would be set to:

```
"AZ$ "; AZ$ zero byte
```

Then, when the routine at EB23 Hex is called, the line is treated as if it were part of a BASIC program.

After this, the routine at E866 Hex waits for a key press. If it is an Escape, the DUMP is terminated.

HEX XX XX XX XX — This allows the conversion of up to 10 Hex numbers into decimal. The routine works on the assumption that the numbers are 16-bit twos-complement binary numbers — this means that the most significant bit is taken to be negative. This is so that the decimal values can be incorporated into DATA statements for use in programs. In fact, the word DATA is printed in front of the converted numbers, all of which are separated by commas. A sample command string and response are shown below:

```
HEX FF AA FFFF 8000  
DATA255,170,-1,32768
```

The cursor is positioned at the D. If the numbers are all large you can lose figures over the end of the line when the shifting to put the word DATA in takes place.

The routine works by calling the NAS-SYS routine DF79 Hex which places up to ten 15-bit Hex values in ARG1 to ARG10 and the number of values in ARG N. An invalid Hex number or more than 10 items causes a return to BASIC with the contents of ARG1 being set to zero (for NAS-SYS 3 users).

The number of items is put into the B register as a counter then, using HL to step through the locations ARG1, etc, each Hex value is copied into the DE register and then exchanged into HL (2320-2370). A check is then made to see if the first bit of HL is set and if it is, the bits of HL are inverted (2000-2350). This gives the ones-complement, and the INC HL at 2460 then converts the value to the twos-complement. A minus sign is then printed. The current position of the numbers and the count are saved and the Hex number in HL is printed in decimal by the BASIC routine at F9AD Hex and a comma is then printed. The registers are retrieved with the position in HL and the looping continues. When the values have been

printed, the printed string from 2550 to 2580 removes the last comma and shifts the line four places to the right to allow the word DATA to be put in. The cursor is set to the left-hand margin, ARG1 is zeroed and a jump to the input routine is made.

The input Hex values, if they are to be used in DOKE statements, should be entered as four digit numbers, with the bytes in reverse order. This needs to be done as the DOKE loads the memory with the low byte first, eg if your program starts DF 62 38 01, you must enter it as 62DF 0138, etc.

Adding Your Own Commands

A save to disc or read from disc routine (DSAVE, DLOAD) is an obvious choice for those with a disc drive. A RENUMBER is also an obvious addition — a version has appeared in Computing Today but this is not in a relative call form and would have to be modified if you want the code to be location independent. The only difficulty, once you have written your routine, is working out the offset to be included in the look-up table LTAB 2640-2670.

The keyword must be added to the end of the table, but you must set the first bit of the first character. This means if the first character was a D or 44 in Hex you would use C4. The table must end with 80 Hex.

If your code is put between the end of HEX (2630) and the start of LTAB (2640), you will have to adjust the values of LTAB and KEYWT accordingly.

Your routines should not touch 0800 to 0809 Hex or change 0C75 Hex or 0C7B Hex unless you are sure you want to!

When called, the new routines have the location after the end of their keyword available in the DE register. Your routines should finish with SCAL Z, a warm start to BASIC or a jump to the input routine.

Finally, I should like to describe the program's method of 'printing' messages, useful if you do not know where code is to be in memory. You set DE and BC to the destination and length of the message and then call the print routine. The first instruction of this POPs HL. This means you lose the return address but gain the start of the message; the LDIR then copies the message. When finished, HL points to the byte after the end of the message — where we wish to return — and a JP (HL) instruction allows the program to continue.

Program Listing

0C80		0100	ORG	\$C80	0D16	BA	0920	CP	D
0C80 0C 0B		0110	ARGN	EQU \$C0B	0D17	28 01	0930	JR	Z L1
0C80 0C 0C		0120	ARG1	EQU \$C0C	0D19	72	0940	LD	(HL) D
0C80 0C 7B		0130	UIN	EQU \$C7B	0D1A	2B	0950	L1	DEC HL
0C80 0C 29		0140	CURLOC	EQU \$C29	0D1B	7E	0960	LD	A (HL)
0C80 10 78		0150	PRISTO	EQU \$1078	0D1C	B7	0970	OR	A
0C80 0C 75		0160	INTAB	EQU \$C75	0D1D	20 FB	0980	JR	NZ L1
0C80 08 05		0170	KEYSTO	EQU \$805	0D1F	23	0990	INC	HL
0C80 08 03		0180	FALST	EQU \$803	0D20	ED 5B 05 08	1000	LD	DE (KEYSTO)
0C80 08 01		0190	TABST	EQU \$801	0D24	01 00 00	1010	LD	BC 0
0C80 EF 0C 00		0200	DEFB	\$EF,\$C,0	0D27	E5	1020	PUSH	HL
0C83 67		0210	LD	H A	0D28	1A	1030	L2	LD A (DE)
0C84 6F		0220	LD	L A	0D29	FE 80	1040	CP	\$80
0C85 22 0C 0C		0230	LD	(ARG1) HL	0D2B	20 06	1050	JR	NZ NOTEND
0C88 D7 00		0240	RCAL	FALS	0D2D	E1	1060	POP	HL
0C8A E1		0250	POP	HL	0D2E	F1	1070	POP	AF
0C8B E5		0260	PUSH	HL	0D2F	C1	1080	POP	BC
0C8C 22 03 08		0270	LD	(FALST) HL	0D30	D1	1090	POP	DE
0C8F 11 49 00		0280	LD	DE ITAB-FALS	0D31	E1	1100	POP	HL
0C92 19		0290	ADD	HL DE	0D32	C9	1110	NOTEND	BIT 7 A
0C93 22 75 0C		0300	LD	(INTAB) HL	0D33	CB 7F	1120	JR	NZ COUNT
0C96 E1		0310	POP	HL	0D35	20 03	1130	NEX	INC DE
0C97 E5		0320	PUSH	HL	0D37	13	1140	JR	L2
0C98 11 4B 00		0330	LD	DE START-FALS	0D38	18 EE	1150	CONT	INC C
0C9B 19		0340	ADD	HL DE	0D3A	0C	1160	AND	\$7F
0C9C 22 7B 0C		0350	LD	(UIN) HL	0D3B	E6 7F	1170	QQ	CP (HL)
0C9F AF		0360	XOR	A	0D3D	BE	1180	JR	Z NEXCHA
0CA0 32 09 08		0370	LD	(\$809) A	0D3E	28 04	1190	POP	HL
0CA3 E1		0380	POP	HL	0D40	E1	1200	PUSH	HL
0CA4 E5		0390	PUSH	HL	0D41	E5	1210	JR	NEX
0CA5 11 C1 01		0400	LD	DE KEYWT-FALS	0D42	18 F3	1220	NEXCHA	INC HL
0CA8 19		0410	ADD	HL DE	0D44	23	1230	INC	HL
0CA9 22 05 08		0420	LD	(KEYSTO) HL	0D45	13	1240	INC	DE
0CAC E1		0430	POP	HL	0D46	1A	1250	LD	A (DE)
0CAD E5		0440	PUSH	HL	0D47	CB 7F	1260	BIT	7 A
0CAE 11 B7 01		0450	LD	DE LTAB-FALS-2	0D49	20 02	1270	JR	NZ FOUND
0CB1 19		0460	ADD	HL DE	0D4B	18 F0	1280	JR	QQ
0CB2 22 01 08		0470	LD	(TABST) HL	0D4D	EB	1290	FOUND	EX DE HL
0CB5 E1		0480	POP	HL	0D4E	2A 01 08	1300	LD	HL (TABST)
0CB6 EF		0490	DEFB	\$EF	0D51	09	1310	ADD	HL BC
0CB7 57 61 72 60		0500	DEFM	/Warm W/	0D52	09	1320	ADD	HL BC
0CBD 0D		0510	DEFB	\$D	0D53	7E	1330	LD	A (HL)
0CBE 43 6F 6C 64		0520	DEFM	/Cold C/	0D54	23	1340	INC	HL
0CC4 0D		0530	DEFB	\$D	0D55	66	1350	LD	H (HL)
0CC5 00		0540	NOP		0D56	6F	1360	LD	L A
0CC6 CF		0550	DEFB	\$CF	0D57	ED 4B 03 08	1370	LD	BC (FALST)
0CC7 FE 43		0560	CP	"C	0D5B	09	1380	ADD	HL BC
0CC9 20 02		0570	JR	NZ WARM	0D5C	F1	1390	POP	AF
0CCB DF 4A		0580	SCAL	"J	0D5D	F1	1400	POP	AF
0CCD FE 57		0590	CP	"W	0D5E	F1	1410	POP	AF
0CCF 20 F5		0600	JR	NZ WAIT	0D5F	F1	1420	POP	AF
0CD1 DF 5A		0610	SCAL	"Z	0D60	F1	1430	POP	AF
0CD3 76 00		0620	DEFB	\$76,0	0D61	E9	1440	JP	(HL)
0CD5 DF 7D		0630	SCAL	\$7D	0D62	E1	1450	MESS	POP HL
0CD7 D0		0640	RET	NC	0D63	ED B0	1460	LDIR	LD HL
0CD8 FE 0D		0650	CP	\$D	0D65	E9	1470	JP	(HL)
0CDA 37		0660	SCF		0D66	21 FD 10	1480	OLD	LD HL \$10FD
0CDB C0		0670	RET	NZ	0D69	23	1490	L3	INC HL
0CDC D9		0680	EXX		0D6A	7E	1500	LD	A (HL)
0CDD B7		0690	OR	A	0D6B	B7	1510	OR	A
0CDE 21 06 00		0700	LD	HL 6	0D6C	20 FB	1520	JR	NZ L3
0CE1 ED 7A		0710	ADC	HL SP	0D6E	22	1530	INC	HL
0CE3 F9		0720	LD	SP HL	0D6F	23 FA 10	1540	LD	(\$10FA) HL
0CE4 DD E1		0730	POP	IX	0D72	5E	1550	L4	LD E (HL)
0CE6 21 F8 FF		0740	LD	HL -8	0D73	23	1560	INC	HL
0CE9 ED 7A		0750	ADC	HL SP	0D74	56	1570	LD	D (HL)
0CEB F9		0760	LD	SP HL	0D75	BA	1580	CP	D
0CEC D9		0770	EXX		0D76	EB	1590	EX	DE HL
0CED 37		0780	SCF		0D77	20 F9	1600	JR	NZ L4
0CEE E5		0790	PUSH	HL	0D79	EB	1610	EX	DE HL
0CEF D5		0800	PUSH	DE	0D7A	23	1620	INC	HL
0CF0 C5		0810	PUSH	BC	0D7B	22 D6 10	1630	LD	(\$10D6) HL
0CF1 F5		0820	PUSH	AF	0D7E	DF 6A	1640	SCAL	\$6A
0CF2 11 D0 0B		0830	LD	BE \$BD0	0D80	DF 5A	1650	SCAL	"Z
0CF5 01 15 00		0840	LD	BC \$15	0D82	EB	1660	DECHEX	EX DE HL
0CF8 D7 68		0850	RCAL	MESS	0D83	2B	1670	DEC	HL
0CFA 54 6F 6F 6C		0860	DEFM	/Toolkit by/	0D84	CD 36 E8	1680	CALL	\$E836
6B 69 74 20					0D87	38 02	1690	JR	C CHA
62 79 20					0D89	DF 5A	1700	BAC	SCAL "Z
0D05 57 20 53 20		0870	DEFM	/W S Lounds/	0D8B	CD A5 E9	1710	CHA	CALL \$E9A5
4C 6F 75 6E					0D8E	EB	1720	EX	DE HL
64 73					0D8F	DF 6A	1730	SCAL	\$6A
0D0F 2A 29 0C		0880	LD	HL (CURLOC)	0D91	DF 66	1740	SCAL	\$66
0D12 DD E5		0890	PUSH	IX	0D93	DF 6A	1750	SCAL	\$6A
0D14 D1		0900	POP	DE	0D95	18 F2	1760	JR	BAC
0D15 7E		0910	LD	A (HL)	0D97	11 78 10	1770	DUMP	LD DE PRISTO
					0D9A	01 0B 00	1780	LD	BC \$B
					0D9D	D7 C3	1790	RCAL	MESS
					0D9F	22 5A 20 20	1800	DEFM	/"Z =" ;Z /
						3D 22 3B 5A			
						20 20			
					0DA9	00	1810	NOP	
					0DAA	2A D6 10	1820	LD	HL (\$10D6)
					0DAD	DF 6A	1830	SCAL	\$6A
					0DAF	ED 5B D8 10	1840	L4	LD DE (\$10D8)

NASCOM UTILITY

0DB3 B7	1850	OR A	0E07 B7	2290	OR A
0DB4 ED 52	1860	SBC HL DE	0E08 28 F2	2300	JR Z NOK
0DB6 19	1870	ADD HL DE	0E0A 47	2310	LD B A
0DB7 38 04	1880	JR C CARON	0E0B 21 0C 0C	2320	LD HL ARG1
0DB9 DF 6A	1890	SCAL \$6A	0E0E 5E	2330	LD E (HL)
0DBB DF 5A	1900	SCAL "Z	0E0F 23	2340	INC HL
0DBD CB 7E	1910	BIT 7 (HL)	0E10 56	2350	LD D (HL)
0DBF 3E 20	1920	LD A "	0E11 23	2360	INC HL
0DC1 28 02	1930	JR Z NOTST	0E12 EB	2370	EX DE HL
0DC3 3E 24	1940	LD A "S	0E13 CB 7C	2380	BIT 7 H
0DC5 32 7B 10	1950	LD (PRISTO+3) A	0E15 28 0A	2390	JR Z PRTNO
0DC8 32 81 10	1960	LD (PRISTO+9) A	0E17 7C	2400	LD A H
0DCB 7E	1970	LD A (HL)	0E18 2F	2410	CPL
0DCC CB BF	1980	RES 7 A	0E19 67	2420	LD H A
0DCE B7	1990	OR A	0E1A 7D	2430	LD A L
0DCF 20 02	2000	JR NZ TWOVAR	0E1B 2F	2440	CPL
0DD1 3E 20	2010	LD A "	0E1C 6F	2450	LD L A
0DD3 32 7A 10	2020	LD (PRISTO+2) A	0E1D 23	2460	INC HL
0DD6 32 80 10	2030	LD (PRISTO+8) A	0E1E EF 2D 00	2470	DEFB \$EF,"-,0
0DD9 23	2040	INC HL	0E21 D5	2480	PUSH DE
0DDA 7E	2050	LD A (HL)	0E22 C5	2490	PUSH BC
0DDB 32 79 10	2060	LD (PRISTO+1) A	0E23 CD AD F9	2500	CALL \$F9AD
0DDE 32 7F 10	2070	LD (PRISTO+7) A	0E26 EF 2C 00	2510	DEFB \$EF,",,0
0DE1 E5	2080	PUSH HL	0E29 C1	2520	POP BC
0DE2 21 78 10	2090	LD HL PRISTO	0E2A E1	2530	POP HL
0DE5 B7	2100	OR A	0E2B 10 E1	2540	DJNZ LOOPH
0DE6 CD 23 EB	2110	CALL \$EB23	0E2D EF 08 17	2550	DEFB \$EF,8,\$17
0DE9 CD 66 E8	2120	CALL \$E866	0E30 16 16 16 16	2560	DEFB \$16,\$16,\$16,\$16
0DEC E1	2130	POP HL	0E34 44 41 54 41	2570	DEFM /DATA/
0DED 23	2140	INC HL	0E38 17 00	2580	DEFB \$17,0
0DEE 23	2150	INC HL	0E3A 67	2590	LD H A
0DEF 23	2160	INC HL	0E3B 6F	2600	LD L A
0DF0 23	2170	INC HL	0E3C 22 0C 0C	2610	LD (ARG1) HL
0DF1 23	2180	INC HL	0E3F 2A 7B 0C	2620	LD HL (\$C7B)
0DF2 18 BB	2190	JR LOOP	0E42 E9	2630	JP (HL)
0DF4 DF 79	2200	SCAL \$79	0E43 DC 00	2640	LTAB
0DF6 08	2210	EX AF AF'	0E45 F8 00	2650	DEFW OLD-FALS
0DF7 DF 6A	2220	SCAL \$6A	0E47 6A 01	2660	DEFW DECHEX-FALS
0DF9 08	2230	EX AF AF'	0E49 0D 01	2670	DEFW HEX-FALS
0DFA 30 08	2240	JR NC OK	0E4B CF 4C 44	2680	DEFW DUMP-FALS
0DFC 21 00 00	2250	LD HL 0	0E4E C4 45 43	2690	DEFB \$80+"O","L","D
0DFE 22 0C 0C	2260	LD (ARG1) HL	0E51 C8 45 58	2700	DEFB \$80+"D","E","C
0E02 DF 5A	2270	SCAL "Z	0E54 C4 55 4D	2710	DEFB \$80+"H","E","X
0E04 3A 0B 0C	2280	LD A (ARGN)	0E57 80	2720	DEFB \$80+"D","U","M
					DEFB \$80



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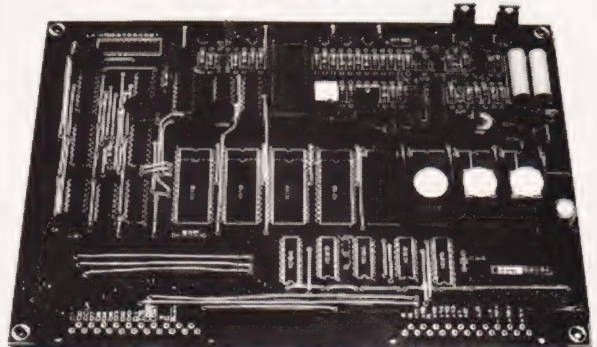
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PUZZLE SQUARE

Fed up with cubes? Move on to squares...

Andrew Thomas

This program is based on the popular game in which one tries to re-arrange the numbered tiles of the puzzle to read 1-15 consecutively. Written in a fairly standard BASIC, the program should run on most machines supporting 4K or more of memory.

The computer may take up to 20 seconds to set up the puzzle; this delay is due to the set-up procedure necessary to avoid impossible puzzles. The computer will state the maximum number of moves it should take to solve the puzzle although it will sometimes be possible to complete the puzzle in fewer moves.

Replying to the question 'WHAT IS YOUR MOVE?', the player must specify first the direction of the move (Left, Right, Up or Down) and second, the number of pieces to be moved (three is the maximum). For convenience, only the first letter of the direction need be typed in and if the number of pieces to move is zero or non-existent, the computer will assume you wish to move as many as possible. Note the numbers move in the direction stated and not the space — if you find this confusing change line 250 to A\$="RLDU" as this will reverse the direction of movement.

The computer will then check to see if the puzzle has been completed and if not, print the puzzle out again (assuming the last move made was valid).

How It Works

For those of you interested in the way the program actually works, the following might prove useful. The puzzle is stored in the 16 element array, A0, and the space is represented as a zero. P has been designated the position of the space in the array, N is the number of pieces to move and D represents the direction in which the pieces move.

Moving on to the listing itself, lines 310-450 set up the puzzle, it is printed out by lines 490-650 and the two lines, 660 and 670, check if the puzzle has been completed. The rest of the program is concerned with movement; lines 720-740 find the numeric equivalent to the direction chosen, lines 810-820 check the move vertically, lines 980-990 check the move horizontally and lines 920-960 actually move the pieces.

```
***** SAMPLE RUN *****
+-----+
| 1 2 3 |
| 5 6 7 4 |
| 9 10 11 8 |
| 13 14 15 12 |
+-----+
MOVE NUMBER 16
WHAT IS YOUR MOVE LEFT 2
+-----+
| 1 2 3 |
| 5 6 7 4 |
| 9 10 11 8 |
| 13 14 15 12 |
+-----+
MOVE NUMBER 17
WHAT IS YOUR MOVE R1
+-----+
| 1 2 3 |
| 5 6 7 4 |
| 9 10 11 8 |
| 13 14 15 12 |
+-----+
MOVE NUMBER 18
WHAT IS YOUR MOVE L
+-----+
| 1 2 3 4 |
| 5 6 7 8 |
| 9 10 11 12 |
| 13 14 15 |
+-----+
WELL DONE .
YOU TOOK 19 MOVES TO COMPLETE THE PUZZLE .
THE PUZZLE COULD HAVE BEEN SOLVED IN 16 MOVES .
DO YOU WANT ANOTHER GAME PLAY AGAIN SOME TIME !!
READY.
```


Program Listing

```

7   REM WRITTEN ON APRIL 1980 WRITTEN ON THE
   'SORCERER'
10  DIM A(16),D(4)
20  PRINTCHR$(12);TAB(26)"NUMBER PUZZLE"
30  PRINTAB(26)" [ 13 - ]"
40  PRINT
50  PRINT
60  PRINT"THIS PROGRAM IS A COMPUTER VERSION OF THE
   POPULAR"
70  PRINT"NUMBER PUZZLE"
80  PRINT
90  PRINT"THE OBJECT OF THE GAME IS TO REARRANGE THE
   PUZZLE"
100 PRINT"SO THAT IT READS 1-15 IN SEQUENCE, WITH 1 AT
   TOP LEFT"
110 PRINT"AND THE SPACE AT BOTTOM RIGHT."
120 PRINT
130 PRINT"WHEN ASKED 'WHAT IS YOUR MOVE' YOU INPUT
   THE DIRECTION"
140 PRINT"IN WHICH YOU WANT TO MOVE THE NUMBERS
   AND OPPOSITE"
150 PRINT"DIRECTION YOU WANT TO MOVE THE SPACE."
160 PRINT"THE DIRECTIONS ARE 'RIGHT', 'LEFT', 'UP' AND
   'DOWN'."
170 PRINT" FOR CONVENIENCE ONLY THE FIRST LETTER IS
   NEEDED."
180 PRINT"BEFORE HITTING 'RETURN' INPUT ALSO THE
   NUMBER THAT YOU"
190 PRINT"WANT TO MOVE. IF YOU INPUT '0' THE PROGRAM
   WILL ASSUME"
200 PRINT"YOU WANT TO MOVE AS MANY AS POSSIBLE."
210 PRINT"THE MAXIMUM YOU CAN MOVE IN ONE GO IS '3'."
220 PRINT
230 PRINT"THE PROGRAM WILL VALIDATE YOUR MOVE."
240 PRINT
250 A$ = "LRUD"
260 M = 0
270 D(1) = - 1
280 D(2) = 1
290 D(3) = - 4
300 D(4) = 4
310 FOR I = 1 TO 15
320 A(I) = I
330 NEXT I
340 A(16) = 0
350 P = 16
360 R = INT(RND(1)*10) + 12
370 FOR W = 1 TO R
380 S = 0
390 N = INT(RND(1)*3) + 1
400 IF ABS(D) = 4 THEN D = D(INT(RND(1)*2) + 1): GOTO 420
410 D = D(INT(RND(1)*2) + 3)
420 GOSUB 820
430 IF N < > 0 AND S = 1 THEN N = 0: S = 0: GOTO 420
440 IF N = 0 AND S = 1 THEN S = 0: D = - D: GOTO 420
450 NEXT W
460 PRINT
470 INPUT" HIT 'RETURN' TO CONTINUE ";Q$
480 W = 0
490 PRINT
500 PRINT"HERE IS THE PUZZLE IT CAN BE SOLVED IN
   ";R;"MOVES."
510 PRINT
520 PRINT" [ + ] [20 - ] [ + ]"
530 PRINT" [ ! ] [20 SPC] [ ! ]"
540 M = M + 1
550 FOR I = 0 TO 12 STEP 4
560 PRINT"!";

570 FOR J = 1 TO 4
580 IF A(I+J) = 0 THENPRINT" [4 SPC]";:P = I + J : GOTO 610
590 IF A(I+J) < 10 THENPRINT" [4 SPC]";A(I+J); : GOTO 610
600 PRINT" [2 SPC]";A(I+J);
610 NEXT J
620 PRINT"!";
630 PRINT" [ ! ] [20 SPC] [ ! ]"
640 NEXT I
650 PRINT" [ + ] [20 - ] [ + ]"
660 FOR I = 1 TO 15
670 IF A(I) = I THEN NEXT I : GOTO 1040
680 PRINT
690 PRINT"MOVE NUMBER ";M;
700 INPUT"WHAT IS YOUR MOVE";Q$
710 PRINT
720 FOR I = 1 TO 4
730 IF LEFT$(Q$,1) = MID$(A$,I,1) THEN 780
740 NEXT I
750 PRINT"ENTRY FORMAT INCORRECT."
760 PRINT"NOW ";
770 GOTO 700
780 D = D(I)
790 GOSUB 810
800 GOTO 520
810 N = VAL(RIGHT$(Q$,1))
820 IFP-(D*N) > 0ANDP-(D*N) < 17ANDP-D > 0ANDP-D < 17 THEN
870
830 IF W < > 0 THEN S = 1 : RETURN
840 PRINT"MOVE IS INVALID."
850 PRINT"NOW ";
860 GOTO 700
870 C = 1
880 IF ABS(D) = 1 THEN 980
890 IF N < > 0 THEN 920
900 IFP-(C*D) > 0ANDP-(C*D) < 17THEN C = C + 1 : GOTO 900
910 N = C - 1
920 FOR I = 1 TO N
930 A(P) = A(P-D)
940 A(P-D) = 0
950 P = P - D
960 NEXT I
970 RETURN
980 E = INT((P-1)/4)*4 + 1
990 IF P-(N*D) < EOR P-(N*D) > E + 3 OR P-D < E OR P-D > E + 3
   THEN 830
1000 IF N < > 0 THEN 920
1010 IF P-(C*D) > = E AND P-(C*D) < E + 4 THEN C = C + 1 :
   GOTO 1010
1020 N = C - 1
1030 GOTO 920
1040 M = M - 1
1050 IF M < = R THEN PRINT"WOW!! OUTSTANDING
   PERFORMANCE !!!!!":GOTO 1090
1060 IF M < R*2 THENPRINT"WELL DONE.":GOTO 1090
1070 IF M < R*4 THENPRINT"AVERAGE
   PERFORMANCE.":GOTO 1090
1080 PRINT"YOU NEED MORE PRACTISE !!!!!"
1090 PRINT"YOU TOOK ";M;"MOVES TO COMPLETE THE
   PUZZLE."
1100 PRINT"THE PUZZLE COULD HAVE BEEN SOLVED IN
   ";R;"MOVES."
1110 PRINT
1120 INPUT"DO YOU WANT ANOTHER GAME":Q$
1130 IF LEFT$(Q$,1) = "Y" THEN 20
1140 PRINT"PLAY AGAIN SOME TIME !!"
1150 END

```


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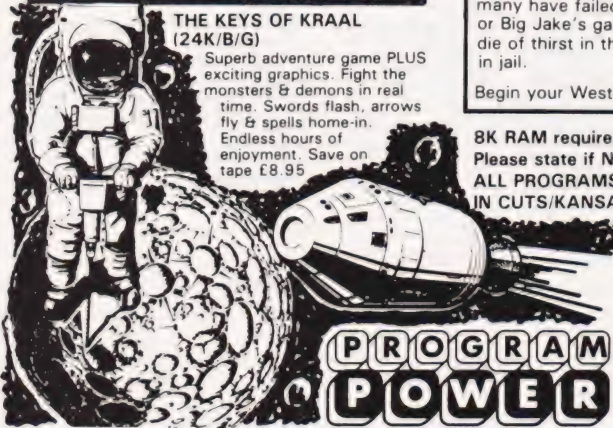
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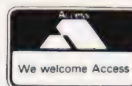
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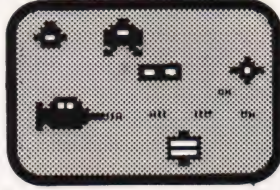
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LVAR	ENDWHILE	KEY X	POP
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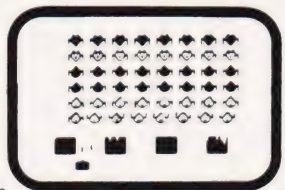
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relationship to a square. However, the new shape will still cover a plane surface when repeated as illustrated in Fig. 2a and b.

If the square is turned through 45 degrees, so that it now looks like a diamond, a similar series of alterations may be made as can be seen in Fig. 3 and Fig. 4.

For a triangular base, there is one change in the method employed. The area subtracted has to be inverted before being added to the adjacent side of the triangle as shown in Fig. 5. The resulting patterns can then be repeated to cover a plane surface as illustrated in Fig. 6. The high resolution screen of the Apple will illustrate the development of the 'tiles' as they are formed, once the original square or triangular base is laid down.

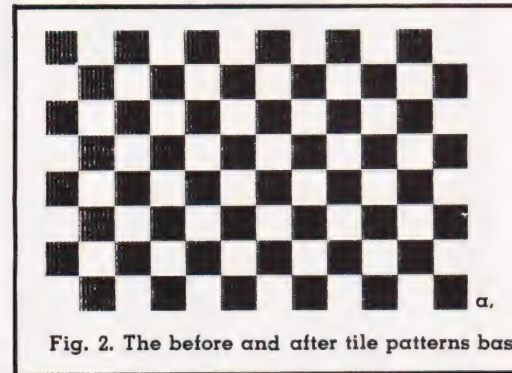


Fig. 2. The before and after tile patterns based on a square.

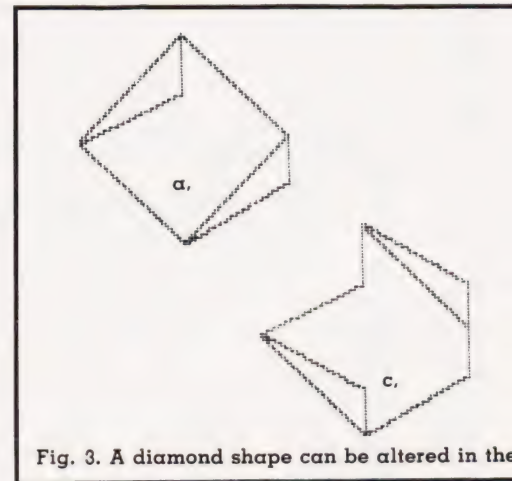


Fig. 3. A diamond shape can be altered in the same way as a square.

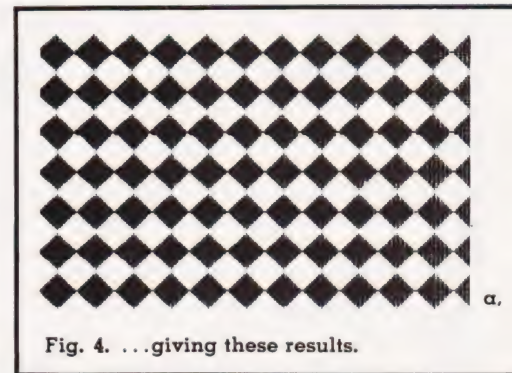


Fig. 4. ...giving these results.

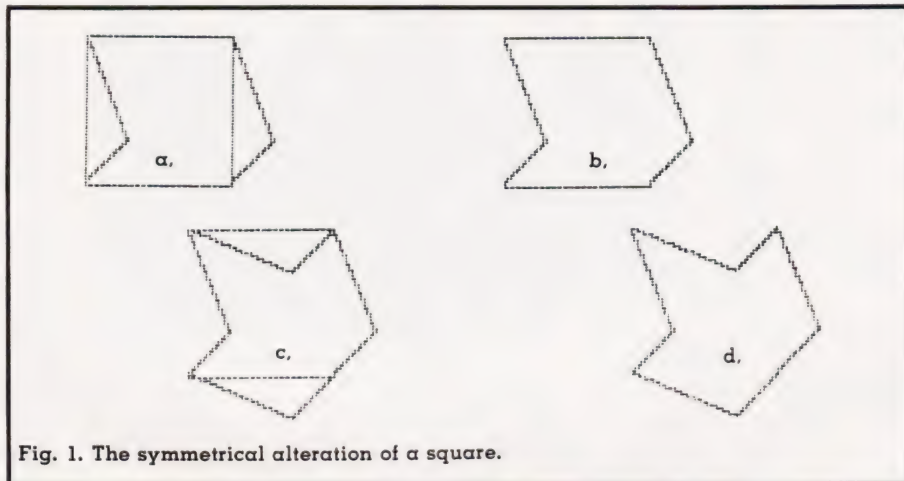


Fig. 1. The symmetrical alteration of a square.

On The Tiles

By following simple rules, we can adapt the regular tessellations to designs, sometimes called 'tile patterns'. This is because a set of tiles, all cut to the same shape, will completely cover the floor.

Consider the simplest shape to start with — a square. When a piece of a square is removed from one side of a square, an identical piece must be added to the outside of the opposite edge of the square (see Figs. 1a and b). The new shape thus formed will fit into an identical shape and has the same area as the original square. Similar alterations to the remaining sides of the square, (see Figs 1c and d), will leave a shape which bears little visual rela-

The co-ordinates of the points to be removed are typed in from the keyboard. On the screen, the given point will be removed, and the replacement added, so that the changing shape is always visible.

```

250 VTAB:PRINT "CO-ORDINATES":
    INPUT X,Y
260 IF X=0 AND Y=0 THEN 300
270 P1(I)=X:Q1(I)=Y:P2(I)=X+16
280 VTAB Y:HTAB X:PRINT " ":
    VTAB Y:HTAB (X+16):PRINT "+"
290 I=I+1:IF I<89 THEN 250
295 HOME:PRINT "YOU HAVE 88 POINTS
    AND THE PATTERN IS ASSUMED
    COMPLETE"
    
```

The co-ordinates are stored in arrays P1(I) and Q1(I), thus restricting the number of possible points to 88. The x co-ordinate of the new point is found by adding 16 to the

P1(I), while the y co-ordinate stays the same. The number (N) of points used is then carried forward to the pattern-making program.

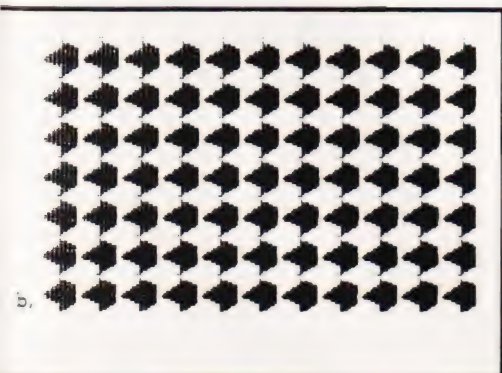
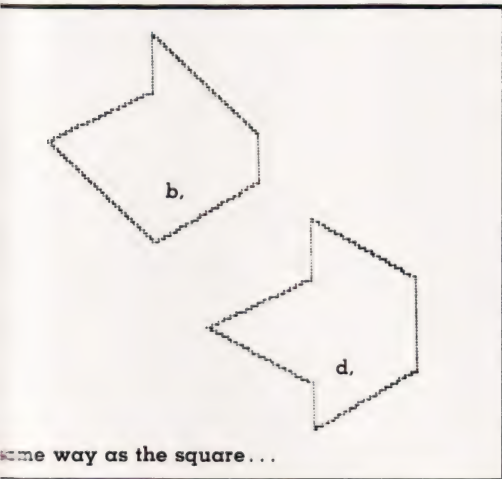
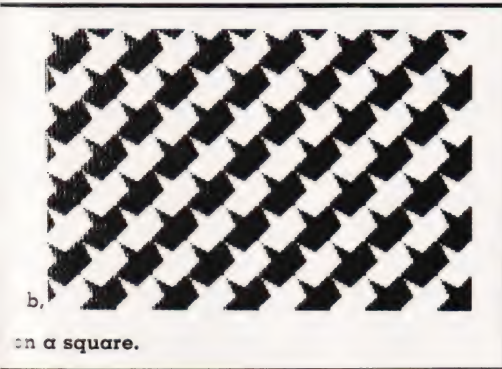
```

320 FOR J=0 TO 5:FOR K=0 TO 3:
    FOR M=9 TO 24:HPOINT J*32+9,
        K*32+M TO J*32+24,K*32+M:
    HPOINT J*32+25,K*32+M+16 TO
        J*32+40,K*32+M+16:
    NEXT M:NEXT K:NEXT J
    
```

The basic square pattern is illustrated in alternative black and white squares (Fig. 2a).

REFLECTIONS

Once the square pattern is completed, the points are moved one by one across the screen by plotting the points to be erased with HCOLOR=0 and the replacement point with HCOLOR=3, (Fig. 2b).



```

330 FOR I=1 TO N:FOR J=0 TO 5:
    FOR K=0 TO 3:HCOLOR=0:
    HPLOT 8+J*32+P1(I),
    K*32+8+Q1(I):
    HPLOT J*32+24+P1(I),
    K*32+24+Q1(I)
340 HCOLOR=3:HPLOT J*32+8+P2(I),
    K*32+8+Q1(I):
    HPLOT J*32+8+P2(I),
    K*32+Q1(I)+24:
    NEXT K:NEXT J:NEXT I
    
```

A Girl's Best Friend

The diamond shape has diagonals 17 points long. The co-ordinates still have their origin at

enclosing square so that a little care is needed to make sure that the co-ordinates given are in the square itself.

The co-ordinates taken in are placed in the array P1 and Q1. The

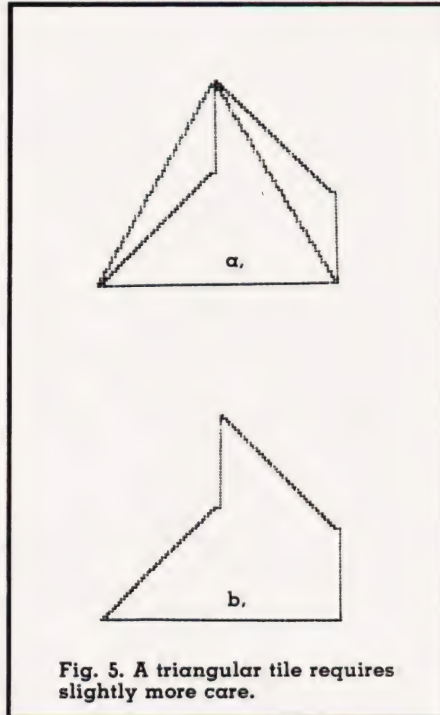


Fig. 5. A triangular tile requires slightly more care.

the top left-hand corner of the x co-ordinate of the replacement point, P2, is found by adding 8 to x and checking whether the value is greater than 17. In a similar way, the y co-ordinate, Q2, is found by subtracting 9 from y and checking that the value is not less than 1.

```

560 VTAB 18:PRINT "CO-ORDINATES ":
    INPUT X,Y
570 IF X=0 AND Y=0 THEN 600
580 P1(I)=X:Q1(I)=Y:P2(I)=X+8:
    Q2(I)=Q1(I)-9
590 IF X>9 THEN P2(I)=P2(I)-17
600 IF Y<9 THEN Q2(I)=Q2(I)+18
610 VTAB Y:HTAB X:PRINT " "
620 P=Y-9:IF P<1 THEN P=P+18
630 Q=X+9:IF Q>19 THEN Q=Q-18
640 VTAB P:HTAB Q:PRINT "+"
650 I=I+1:IF I<89 THEN 560
655 HOME:PRINT "YOU HAVE 88 POINTS
    AND THE PATTERN IS ASSUMED
    COMPLETE"
660 N=I-1:HGR:HCOLOR=3
680 FOR J=0 TO 10:FOR K=0 TO 7:
    FOR R=0 TO 8:
    HPLOT J*17+(9-R),K*18+R+1 TO
    J*17+9+R,K*18+R+1:NEXT R
690 FOR R=7 TO 0 STEP -1:
    HPLOT J*17+9-R,K*18+17-R TO
    J*17+9+R,K*18+17-R:NEXT R
700 NEXT K:NEXT J
710 FOR I=1 TO N:FOR J=0 TO 10:
    FOR K=0 TO 7
720 HCOLOR=0:HPLOT J*17+P1(I),
    K*18+Q1(I)
730 HCOLOR=3:P=J*17+P2(I):
    IF P>270 THEN P=P-270
740 Q=K*18+Q2(I):IF Q>145 THEN
    Q=Q-144
750 HPLOT P,Q:NEXT K:NEXT J:NEXT I:
    GOSUB 780:GOTO 20
    
```

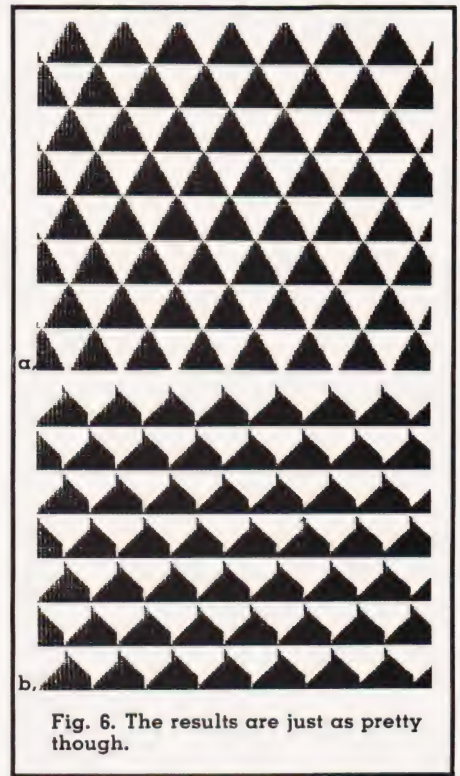


Fig. 6. The results are just as pretty though.

The diamond base is printed out as above and then the points are moved as in the square (Fig. 4a and b).

A Tile From Bermuda?

An equilateral triangle is not very easy to illustrate on the 25 by 40 screen. When the points are translated onto the high resolution screen, the triangular network is recognisable, although the edges are slightly blurred, see Fig. 6a.

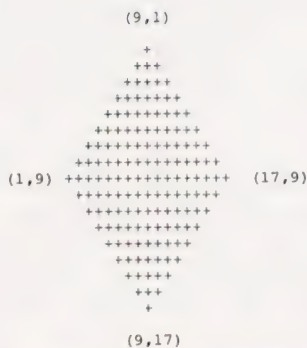
The triangle used to design the changed shape does, however, look rather strange. It has a vertical height of 20 points and a horizontal base of 23 points. The co-ordinates are based on the surrounding square as before, so that the top vertex is the point (12,1), and the ends of the base are (1,20) and (23,20).

Once the element is complete, drawing the triangular base on the high resolution graphics screen is a

```

(1,1) (16,1)
+++++
+++++
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+++++
+++++
+++++
+++++
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+++++
+++++
+++++
+++++
(1,16) (16,16)
    
```

The square base pattern.



The diamond base pattern.

rather longer process than for the previous two examples. This is because of the more irregular length of the horizontal lines used to draw each triangle. The program is found in lines 3290 to 3790.

Once the base is drawn, the changes are made quite easily because the co-ordinate system is still based on rectangular axes (Fig. 6a and b).

```

3280 FOR I=1 TO N:FOR J=0 TO 8:
FOR K=0 TO 3
3830 HCOLOR=0:HPLLOT J*24+P1(I),
K*40+Q1(I):
HPLLOT J*24+P1(I)+12,
K*40+Q1(I)+20
3840 HCOLOR=3:HPLLOT J*24+P2(I),
K*40+Q2(I):
HPLLOT J*24+P2(I)+12,
K*40+Q2(I)+20:
NEXT K:NEXT J:NEXT I

```

The program for the triangular-based tiles has been given separately from the square and diamond shape tiles to avoid any difficulties when using discs with the HGR



The triangular base pattern.

screen. As they stand, they will fit without trouble into an Apple with discs and 48K of memory.

Program Listing

```

5 DIM P1(88),P2(88),Q1(88),Q2(88)
6 HOME : UTAB 6: HTAB 7: PRINT "*****"
7 HTAB 7: PRINT "+ "
8 HTAB 7: PRINT "+ TILE PATTERNS "
9 HTAB 7: PRINT "+ "
10 HTAB 7: PRINT "+ G.H.GALLAGHER "
11 HTAB 7: PRINT "+ "
12 HTAB 7: PRINT "+ 1982 "
13 HTAB 7: PRINT "+ "
14 HTAB 7: PRINT "*****"
15 FOR I = 1 TO 2000: NEXT
20 TEXT : HOME : PRINT "TYPE 1 FOR SQUARE BASE"
30 PRINT " 2 FOR DIAMOND BASE"
60 PRINT " 3 TO END"
70 INPUT A: ON A GOTO 80,380,370
80 HOME : PRINT "*****"
90 PRINT "*****"
100 PRINT "*****"
110 PRINT "*****"
120 PRINT "*****"
130 PRINT "*****"
140 PRINT "*****"
150 PRINT "*****"
160 PRINT "*****"
170 PRINT "*****"
180 PRINT "*****"
190 PRINT "*****"
200 PRINT "*****"
210 PRINT "*****"
220 PRINT "*****"
230 PRINT "*****"
240 I = 1
250 UTAB 18: PRINT "CO-ORDINATES": INPUT X,Y
260 IF X = 0 AND Y = 0 THEN 300
270 P1(I) = X:Q1(I) = Y:P2(I) = X + 16
280 UTAB Y: HTAB X: PRINT " ": UTAB Y: HTAB (X + 16): PRINT "+"
290 I = I + 1: IF I > 89 THEN 250
295 HOME : PRINT "YOU HAVE 88 POINTS.YOUR PATTERN IS ASSUMED TO BE C
COMPLETE"
300 HGR : HCOLOR= 3:N = I - 1
320 FOR J = 0 TO 5: FOR K = 0 TO 3: FOR M = 9 TO 24: HPLLOT J * 32 + 9,K *
32 + M TO J * 32 + 24,K * 32 + M: HPLLOT J * 32 + 25,K * 32 + M + 16 TO
J * 32 + 40,K * 32 + M + 16: NEXT M: NEXT K: NEXT J
330 FOR I = 1 TO N: FOR J = 0 TO 5: FOR K = 0 TO 3: HCOLOR= 0: HPLLOT 8 +
J * 32 + P1(I),K * 32 + 8 + Q1(I): HPLLOT J * 32 + 24 + P1(I),K * 32 +
24 + Q1(I)
340 HCOLOR= 3: HPLLOT J * 32 + 8 + P2(I),K * 32 + 8 + Q1(I): HPLLOT J * 32 -
8 + P2(I),K * 32 + Q1(I) + 24: NEXT K: NEXT J: NEXT I
350 GOSUB 780
360 GOTO 20
370 END
380 HOME : PRINT " + "
390 PRINT " +++ "
400 PRINT " +++++ "
410 PRINT " ++++++ "
420 PRINT " +++++++ "
430 PRINT " ++++++++ "
440 PRINT " ++++++++ "
450 PRINT " ++++++++ "
460 PRINT " ++++++++ "
470 PRINT " ++++++++ "
480 PRINT " ++++++++ "
490 PRINT " ++++++++ "
500 PRINT " ++++++++ "
510 PRINT " ++++++ "
520 PRINT " +++++ "
530 PRINT " +++ "
540 PRINT " + "
550 I = 1
560 UTAB 18: PRINT "CO-ORDINATES": INPUT X,Y
570 IF X = 0 AND Y = 0 THEN 660
580 P1(I) = X:Q1(I) = Y:P2(I) = X + 8:Q2(I) = Q1(I) - 9
590 IF X > 9 THEN P2(I) = P2(I) - 17
600 IF Y < 9 THEN Q2(I) = Q2(I) + 18
610 UTAB Y: HTAB X: PRINT " "
620 P = Y - 9: IF P < 1 THEN P = P + 18
630 Q = X + 9: IF Q > 18 THEN Q = Q - 18
640 UTAB P: HTAB Q: PRINT "+"
650 I = I + 1: IF I < 89 THEN 560
660 HOME : PRINT "YOU HAVE 88 POINTS.YOUR PATTERN IS ASSUMED TO BE C
COMPLETE."
670 N = I - 1: HGR : HCOLOR= 3
680 FOR J = 0 TO 14: FOR K = 0 TO 7: FOR R = 0 TO 8: HPLLOT J * 17 + (9 -
R),K * 18 + R + 1 TO J * 17 + 9 + R,K * 18 + 18 + R + 1: NEXT R
690 FOR R = 7 TO 0 STEP - 1: HPLLOT J * 17 + 9 - R,K * 18 + 17 - R TO J *
17 + 9 + R,K * 18 + 17 - R: NEXT R
700 NEXT K: NEXT J
710 FOR I = 1 TO N: FOR J = 0 TO 14: FOR K = 0 TO 7
720 HCOLOR= 0: HPLLOT J * 17 + P1(I),K * 18 + Q1(I)
730 HCOLOR= 3:P = J * 17 + P2(I): IF P > 270 THEN P = P - 270
740 Q = K * 18 + Q2(I): IF Q > 145 THEN Q = Q - 144
750 HPLLOT P,Q: NEXT K: NEXT J: NEXT I: GOSUB 780: GOTO 20
780 UTAB 21: PRINT "PRESS ANY KEY TO CONTINUE"
790 GET A$: IF A$ = "" THEN 790
800 RETURN

```


REFLECTIONS

```

10 DIM P1(88),P2(88),O1(88),O2(88)
2900 HOME : UTAB 6: HTAB 7: PRINT "*****"
2910 HTAB 7: PRINT "+ "
2920 HTAB 7: PRINT "+ TRIANGULAR BASED "
2930 HTAB 7: PRINT "+ TILES "
2940 HTAB 7: PRINT "+ "
2950 HTAB 7: PRINT "+ G.H.GALLAGHER "
2960 HTAB 7: PRINT "+ 1982 "
2970 HTAB 7: PRINT "+ "
2980 HTAB 7: PRINT "*****"
2990 FOR I = 1 TO 2000: NEXT
3000 REM :TRIANGLE
3010 HOME : PRINT " "
3020 PRINT " +++ "
3030 PRINT " +++++ "
3040 PRINT " +++++ "
3050 PRINT " ++++++ "
3060 PRINT " ++++++ "
3070 PRINT " ++++++ "
3080 PRINT " ++++++ "
3090 PRINT " ++++++ "
3100 PRINT " ++++++ "
3110 PRINT " ++++++ "
3120 PRINT " ++++++ "
3130 PRINT " ++++++ "
3140 PRINT " ++++++ "
3150 PRINT " ++++++ "
3160 PRINT " ++++++ "
3170 PRINT " ++++++ "
3180 PRINT " ++++++ "
3190 PRINT " ++++++ "
3200 PRINT " ++++++ "
3210 I = 1
3220 UTAB 21: PRINT "CO-ORDINATES": INPUT X,Y
3230 IF X = 0 OR Y = 0 THEN 3280
3240 P1(I) = X:O1(I) = Y:O2(I) = 21 - Y:P2(I) = 12 + X
3250 UTAB V: HTAB X: PRINT " "
3260 UTAB O2(I): HTAB P2(I): PRINT "+"
3270 I = I + 1: IF I < 89 THEN 3220
3275 HOME : PRINT "YOU HAVE 88 POINTS.YOUR PATTERN IS ASSUMED TO BE
COMPLETE."
3280 N = I - 1: HGR : HCOLOR= 3
3290 FOR J = 0 TO 8: FOR K = 0 TO 3
3300 P = 24 + J + 12:O = 40 + K + 1: GOSUB 3880: HPLLOT P,O
3320 P = 24 + J + 13:O = 40 + K + 2: GOSUB 3880: HPLLOT 24 + J + 11,O TO P,
O
3340 P = 24 + J + 14:O = 40 + K + 4: GOSUB 3880: HPLLOT 24 + J + 10,O - 1 TO
P,O - 1
3360 HPLLOT 24 + J + 10,O TO P,O:P = 24 + J + 15:O = 40 + K + 6: GOSUB 388
0: HPLLOT 24 + J + 9,O - 1 TO P,O - 1
3380 HPLLOT 24 + J + 9,O TO P,O:P = 24 + J + 16:O = 40 + K + 8: GOSUB 3880
3410 HPLLOT J + 24 + 8,O - 1 TO P,O - 1: HPLLOT J + 24 + 8,O TO P,O:P = 24 +
J + 17:O = 40 + K + 9: GOSUB 3880
3430 HPLLOT 24 + J + 7,O TO P,O:P = 24 + J + 18:O = 40 + K + 11: GOSUB 388
0: HPLLOT 24 + J + 6,O - 1 TO P,O - 1: HPLLOT 24 + J + 6,O TO P,O
3460 P = 24 + J + 19:O = 40 + K + 13: GOSUB 3880: HPLLOT 24 + J + 5,O - 1 TO
P,O - 1: HPLLOT 24 + J + 5,O TO P,O
3480 P = 24 + J + 20:O = 40 + K + 15: GOSUB 3880: HPLLOT 24 + J + 4,O - 1 TO
P,O - 1: HPLLOT 24 + J + 4,O TO P,O
3500 P = 24 + J + 21:O = 40 + K + 17: GOSUB 3880: HPLLOT 24 + J + 3,O - 1 TO
P,O - 1: HPLLOT 24 + J + 3,O TO P,O
3520 P = 24 + J + 22:O = 40 + K + 19: GOSUB 3880: HPLLOT 24 + J + 2,O - 1 TO
P,O - 1: HPLLOT 24 + J + 2,O TO P,O
3540 P = 24 + J + 23:O = 40 + K + 20: GOSUB 3880: HPLLOT 24 + J + 1,O TO P,
O
3560 P = 24 + J + 24:O = 40 + K + 21: GOSUB 3880: HPLLOT P,O: HPLLOT 24 + J +
23,K + 40 + 22 TO 24 + J + 25,K + 40 + 22
3580 P = 24 + J + 26:O = 40 + K + 24: GOSUB 3880: HPLLOT 24 + J + 22,O - 1 TO
P,O - 1
3610 HPLLOT 24 + J + 22,O TO P,O:P = 24 + J + 27:O = 40 + K + 26: GOSUB 38
80: HPLLOT 24 + J + 21,O - 1 TO P,O - 1
3640 HPLLOT 24 + J + 21,O TO P,O:P = 24 + J + 28:O = 40 + K + 28: GOSUB 38
80: HPLLOT J + 24 + 20,O - 1 TO P,O - 1: HPLLOT J + 24 + 20,O TO P,O
3670 P = 24 + J + 29:O = 40 + K + 29: GOSUB 3880: HPLLOT 24 + J + 19,O TO P
,O:P = 24 + J + 30:O = 40 + K + 31: GOSUB 3880
3680 HPLLOT 24 + J + 19,O TO P,O:P = 24 + J + 30:O = 40 + K + 31: GOSUB 38
80: HPLLOT 24 + J + 18,O - 1 TO P,O - 1: HPLLOT 24 + J + 18,O TO P,O
3710 P = 24 + J + 31:O = 40 + K + 33: GOSUB 3880: HPLLOT 24 + J + 17,O - 1 TO
P,O - 1: HPLLOT 24 + J + 17,O TO P,O
3730 P = 24 + J + 32:O = 40 + K + 35: GOSUB 3880: HPLLOT 24 + J + 16,O - 1 TO
P,O - 1: HPLLOT 24 + J + 16,O TO P,O
3750 P = 24 + J + 33:O = 40 + K + 37: GOSUB 3880: HPLLOT 24 + J + 15,O - 1 TO
P,O - 1: HPLLOT 24 + J + 15,O TO P,O
3770 P = 24 + J + 34:O = 40 + K + 39: GOSUB 3880: HPLLOT 24 + J + 14,O - 1 TO
P,O - 1: HPLLOT 24 + J + 14,O TO P,O
3790 P = 24 + J + 35:O = 40 + K + 40: GOSUB 3880
3800 HPLLOT 24 + J + 13,O TO P,O
3810 NEXT K: NEXT J
3820 FOR I = 1 TO N: FOR J = 0 TO 8: FOR K = 0 TO 3
3830 HCOLOR= 0: HPLLOT J + 24 + P1(I),K + 40 + O1(I): HPLLOT J + 24 + P1(I)
+ 12,K + 40 + O1(I) + 20
3840 HCOLOR= 3: HPLLOT J + 24 + P2(I),K + 40 + O2(I): HPLLOT J + 24 + P2(I)
+ 12,K + 40 + O2(I) + 20
3850 NEXT K: NEXT J: NEXT I
3860 FOR I = 0 TO 159: HCOLOR= 0: HPLLOT 1,I TO 23,I: HPLLOT 217,I TO 250,I
: NEXT I: HPLLOT 1,1 TO 256,1
3870 END
3880 IF P < 240 THEN P = P - 240
3890 IF O > 159 THEN O = O - 159:P = P - 12
3900 RETURN

```

An extra line has been added to tidy up the screen outline, ie to remove the odd half patterns which are on the edges.

```

3860 FOR I=0 TO 159:HCOLOR=0:
HPLLOT 1,I TO 23,I:
HPLLOT 217,I TO 250,I:
NEXT I:HPLLOT 1,1 TO 256,1

```

Six Of The Best

The hexagonal base is hidden in the triangular base and can be seen by changing the colouring scheme (Fig. 7). Unfortunately, the hexagonal element would require a larger screen than is available in low resolution if the same system of

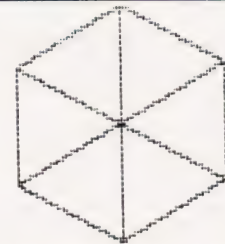
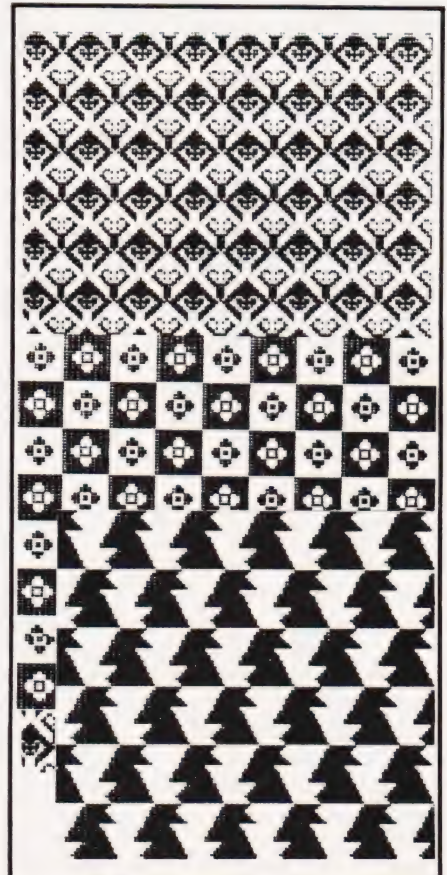


Fig. 7. The hexagon causes a few problems!

changing points were to be used. So, the solution has been postponed until another system of changing the shapes can be illustrated. Sorry.



Some typical 'advanced' tile patterns.

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(machine code)



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(machine code)



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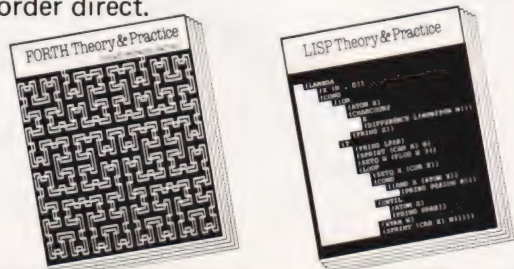
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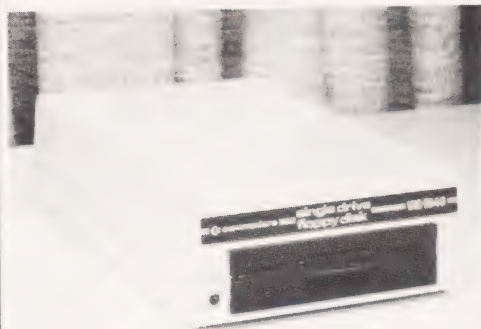
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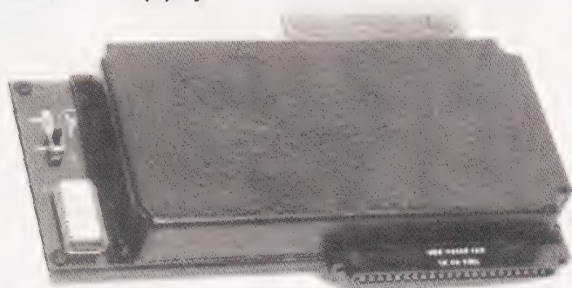
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The final episode in our BASIC programming for beginners series looks at the subject of arrays and how to use them.

Well, we have finally come to the end of this series of First Bytes and yet it seems like only yesterday that we started out by explaining the meaning of PRINT. Doubtless those of you who remember that, have progressed a very long way since then! I hope so.

One area a number of people have said gives them problems when first they meet it is that of the array. Arrays should not be so difficult to grasp and are in fact very useful things. Basically, they are really just another way of writing a variable and are much easier to use than variables with a discrete letter assigned to them such as:

```
10 A = 11
20 B = 12
30 C = 13
40 D = 14
```

Arrays are written in the form A(N) where N is the number of variables you wish to use. When talking of arrays we use the term 'elements' so using the example A(N), N is the number of elements in the array.

Watch Your Step

Say, for example, we wish to produce a memory testing game in which you are blindfolded and have to take 20 steps across a floor that has steps up or down for each step you take. You are led across the floor once — you must then start at the beginning and walk across without falling over! You could do this on the computer using ordinary variables and determining whether the steps required are up or down for each of 20 variables (A-T). You then test your memory by trying to repeat these steps 20 times. Using discrete variables, this simple game would require something in the order of over 200 program lines! The determination of up or down may take the form:

```
10 PRINT "FIRST STEP"
20 GOSUB 5000
30 PRINT AS
40 A = Z
50 GOSUB 8000
```

Line 20 of the above program determines whether each step is up or down assigning this string to A\$ and assigning Z as 0 for up and 1 for down. Line 40 assigns your first variable, A, to the flag for up or down (0 or 1) and line 50 provides a

delay enabling you to read what has been PRINTed and could be altered to suit the desired skill level. This little routine would then have to be repeated 20 times!

Having determined the course, you then have to negotiate it:

```
1000 PRINT "WHAT IS FIRST STEP"
1010 INPUT "UP OR DOWN "; BS
1020 GOSUB 6000
1030 IF A <> Y THEN 7000
```

Line 1030 assigns a flag 0 or 1 dependent upon the INPUT in line 1020 of up or down. Line 1040 checks to see if you have made the right choice for that step and line 7000 will tell you if you failed. This routine has to be repeated 20 times too!

This program does go on...and on! However, using an array can make things a little simpler. If you look at the program in Listing 1, you will see that only 25 lines of program are employed instead of over 200, simply by using an array. Note that when using an array you must specify the number of elements it may contain. For this we use the DIM statement (short for DIMension) in line 10. RND(3) in line 30 provides us with a random number between 0 and 1.

The useful thing about arrays is that you may assign to or call back an element of an array by having a variable within the brackets, for example, in lines 50, 80 and 210. This means that the information held in that element may be accessed within a FOR...NEXT loop. Arrays must be DIMensioned at the beginning of the program and must not be re-DIMensioned again within the program (the ZX81 is an exception).

Hooray for Arrays

The array we have seen so far, A(N), is a one-dimensional array. Depending on the capabilities of your machine, you may have a two-dimensional array, A(M,N), a three-dimensional array, A(M,N,P), or more! A two-dimensional array is still only another way of representing a variable and is only one number and *not* two! Arrays may be either numeric, ie A(N), B(N), or they may be string arrays, ie A\$(N), B\$(N).

As we can utilise FOR...NEXT loops easily with arrays, we can also READ...DATA statements too. This

means we can assign 10,20 or 200 variables very easily indeed:

```
10 DIM D(20)
20 FOR I = 1 TO 20
30 READ A
40 D(I) = A
50 NEXT I
60 .. ..
70 .. ..
1000 DATA 1,3,5,6,8,2,5,8,2,9
1010 DATA 2,5,6,7,3,7,7,8,1,4
```

We have now assigned all the values in the DATA statements in lines 1000 and 1010 to the array D(20). They may represent the distance between railway stations or the number of shooting stars you saw on consecutive nights! *But*, they are now in a form you can work on:

```
100 Z = 0
110 INPUT X,Y
120 FOR I = X TO Y
130 Z = Z + D(I)
140 NEXT I
150 PRINT Z
```

The above little routine would give the sum of all elements between the Xth and Yth element. However, substitute for line 150:

```
150 PRINT Z / (Y-X)
```

and you get the average number of shooting stars seen between any specified consecutive number of nights!

Strung Out

Using string arrays can be just as simple, for example, you may wish to construct a maze for a game. The routine given in Listing 2 will display the directions you may move in for a grid pattern of five by five 'rooms'. The program is a little long-winded and there are shorter routines to give required directions but this should point the way!

One point to note with arrays is that most BASICs allow the use of the zero'th element, in other words, B(6) has seven elements:

```
B(0),B(1),B(2),B(3),B(4),B(5) and B(6)
```

This can be confusing and although you have dimensioned an array, eg B(6), you do not have to use B(0). Just remember that when you have told the computer to put aside a certain amount of memory. For example, M(50,20), does not look like much but it represents 1000 elements! A few machines (such as

FIRST BYTES

the Texas TI 99/4A) allow you to specify whether an array starts at zero or one.

Also remember that array elements must be positive; A(-2) will result in an error message (the variable an element refers to may of course be of either sign). When you DIMension an array at the beginning of your program do ensure you have enough elements for your needs. If you DIMension an array for ten elements, A(9), and try to assign a value to A(10) then again an error message will be displayed.

Arrays are often used for what are commonly called 'look-up tables' and a simple variant of this can produce a simple teaching program:

```
10 DIM A(20),A$(20)
20 FOR I = 1 TO 20
30 READ B$,B
40 A$(I) = B$
50 A(I) = B
60 NEXT I
70 R = 2 * INT(RND(5)*10) + 1
80 PRINT "TYPE IN YOUR ANSWER TO : "
90 PRINT A$(R)
100 INPUT "ANS. = "; X
110 IF X <> A(R) THEN 200
120 PRINT "*** WELL DONE ***"
130 GOTO 500
```

```
200 PRINT "YOU MADE A MISTAKE"
210 PRINT "THE ANSWER IS ";A(R)
500 FOR I = 1 TO 1000
510 NEXT I
520 CLS
530 GOTO 70
600 DATA 3*7,21,60/15,4,4*1.5,6
610 DATA 720+56,776,882/10,88.2,13*5
620 DATA 55,32+23,55,66/11,6,5*9,45
630 DATA .. .. .
```

```
10 DIM A(20)
20 FOR I = 1 TO 20
30 IF RND(3) > 0.5 THEN 70
40 AS = "UP"
50 A(I) = 0
60 GOTO 90
70 AS = "DOWN"
80 A(I) = 1
90 PRINT "STEP NO. ";I;" IS ";AS
100 FOR K = 1 TO 1000
110 NEXT K
120 NEXT I
130 PRINT "HOW IS YOUR MEMORY ?"
140 FOR I = 1 TO 20
150 INPUT "STEP NO. ";I;" IS ";B$
160 IF LEFT$(B$,1) = "U" THEN 200
170 IF LEFT$(B$,1) <> "D" THEN 300
180 Y = 1
190 GOTO 210
200 Y = 0
210 IF Y <> A(I) THEN 300
220 PRINT "SO FAR SO GOOD !"
230 NEXT I
240 PRINT "**** WELL DONE ****"
250 PRINT "**** TRY AGAIN ****"
260 GOTO 310
300 PRINT "OH DEAR YOU FELL DOWN !"
310 END
```

Listing 1

Lines 20 to 60 assign the question to array A\$() and the answers to array A(). Note that the DATA statements are alternatively question, answer, question, answer, etc.

Line 70 generates an odd integer between one and 19. Line 90 PRINTs the question in that element

```
10 DIM L$(5,5)
20 FOR I = 1 TO 5
30 FOR J = 1 TO 5
40 READ AS
50 L$(I,J) = AS
60 NEXT J
70 NEXT I
80 INPUT "CO-ORDINATES X (1-5) , Y (1-5)";X,Y
90 IF X<1 OR X>5 OR Y<1 OR Y>5 THEN 80
100 PRINT L$(X,Y)
110 GOTO 80
1000 DATA NSEW,NSE,NSW,SW,SE,SE,
        NSEW,SWE,NSE,EW
1010 DATA NSW,NSW,NE,NSE,SWE,SE,SWE,
        NSEW,NSEW
1020 DATA .. .. .
```

Listing 2

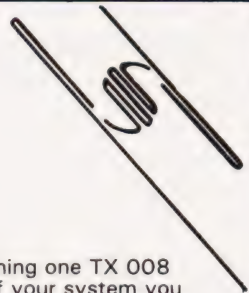
of array A\$() determined by the random number from line 70 and line 110 checks to see if your answer is correct.

I hope that from these few examples you will be able to appreciate how useful the array can be.

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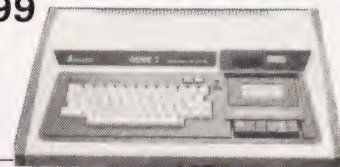
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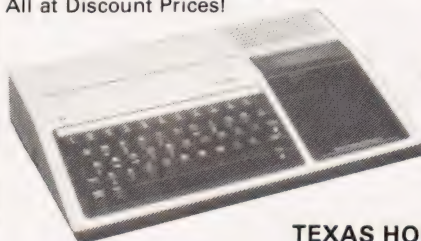
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CT-7-82

Dear Sir,

I have acquired a BBC Model B Micro, with which I am well pleased. However, the UHF output is poor, especially compared to VIC and Atari systems which I have seen.

Not wishing to go to the expense of a RGB monitor, is there an encoder/modulator which would provide a better output on the market? Presumably, as the RGB outputs are available, the encoder could connect here, possibly to one of the new TVs which have video input.

Yours faithfully,
J Marshall
Southampton

(* I'm somewhat surprised at your comments on the quality. Try replacing the UHF lead supplied with a decent one, a true 75 Ohm UHF downlead with proper UHF connectors, and you may well see a remarkable improvement. Ensure also that your micro is not too close to the TV at this can de-tune the set or cause TVI in some cases. There is no point whatsoever in re-modulating the RGB signal, you would end up with exactly the same as you are getting out of the UHF output. The new style TVs with video input are for a composite signal, not a split RGB so it is, in theory at least, possible to regenerate a composite signal and use this. However, once again the quality would drop. I have had no trouble with either of the BBC Micros in our office — we use an NEC green screen monitor for one and a Microvitec colour monitor for the other but both have operated successfully on a conventional colour TV set (a 22" Ferguson TX) . . . but the latter is used with a decent lead and not the piece of string supplied! Ed *)

Dear Sir,

In view of the recently-published article by Owen Bishop entitled 'THE ARGUS', we would like to inform your readers and contributors that 'ARGUS' is a Registered Trade Mark of Ferranti plc in respect of computers and computer systems.

Yours faithfully,
FERRANTI plc

Dear Sir,
I was very interested to read the article on FORTH in Computing

Today and I thought it might be instructive to compare the FORTH version of 'Towers of Hanoi' with a version in BASIC for the BBC Microcomputer. The program (see listing) displays the Towers in coloured graphics (MODE 7) and takes advantage of the ability to define recursive procedures in BBC BASIC, so is very comparable in operation to the FORTH version.

This BASIC version takes 187 seconds, as compared to 232 seconds for the published FORTH version.

Yours sincerely,
Tim Dobson
Acornsoft Ltd
4a Market Hill
Cambridge CB2 3NJ

```

0 REM Tower of Hanoi Problem
10 INPUT "Number of discs "F%
20 N%=TIME
30 K%=13
40 H%=1
50 @%=2
60 MODE 7
70 VDU23; 10, 32, 0; 0; 0;
80 DIM A$(12), P%3
90 FOR I%=1 TO 3:P%? I%=20:NEXT
100 FOR I%=1 TO 11 STEP 2
110 A$(I%)=CHR$(@91+I%MOD7)+
CHR$106+STRING$(I%-1,
CHR$255)+CHR$53+CHR$@ 98
120 A$(I%+1)=CHR$(@91+(I%+1)MOD7)
+STRING$(I%+1,CHR$255)+
CHR$@98
130 NEXT
140 FOR A%=F% TO 1 STEP
-1:P%?1=P%?1-H%:PRINT
TAB((12-A%)/DIV2,P%?1);
A$(A%);:NEXT
150 PRINT TAB(2,22)"Move disk from Pile
to Pile";
160 PROCH(F%,1,3)
170 PRINT CHR$30"It took "(TIME-N%)/
100" seconds"
180 END
190 DEF PROCH(A%,B%,C%) IF A%=0
END PROC
200 PROCH(A%-1,B%,6-B%-C%)
210 P%?C%=P%?C%-H%
220 PRINT TAB(12,22)A% TAB(25,22);
B%TAB(35,22); C%TAB(K%*B%-K%
+(12-A%)/DIV2,P%?B%)CHR$%98
TAB(K%*C%-K%+(12-A%)/DIV2,
P%?C%) A$(A%);
230 P%?B%=P%?B%+H%
240 PROCH(A%-1,6-B%-C%,C%)
250 END PROC
    
```

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and we'll do our best to make them public.

Dear Sir,

Through the columns of your magazine could I please mention the formation of the RAF Coltishall Computer Club. At present the Club boasts 22 members and 12 machines including an Apple II and Video Genie both complete with disc and printer; four MZ-80Ks; a Superboard; a VIC 20; a PET and numerous ZX-81's. The club is also in the process of purchasing the BBC computer.

We meet on the first and third Thursday of each month in the Motor Club Social Centre at RAF Coltishall. The meetings usually start at 19.30 hrs.

Visitors to the Station are required to register at the Guardroom on arrival but before anyone travels any distance, I would recommend they contact me in case Service commitments prevent a meeting taking place.

Yours faithfully,
D C McCandless
Sgts Mess
RAF Coltishall
Nr Norwich
Norfolk
0603 737361 ext 308

Dear Sir,

Thanks for your superb early (March 27) April Fool. I refer to your article (joke?) about FAD-T in April's CT. I know there are some fairly perverse languages around but if FAD-T did indeed exist it would surely take the prize for programmers' nightmare of the year.

What is more — naming no names — I can just imagine which machine it would be written for!

But seriously, features such as CORRUPT, FORGET and COME FROM plus the even-lines-only features could be very useful under certain conditions. Why doesn't some genius build these into a version of Pascal or BASIC?

Yours faithfully,
Phillip L Watson
Bedford

(* Are there any volunteers to write us a FAD-T interpreter? As Mr Watson suggests, the language might have real benefits as compared with some other programming tools! Ed. *)

Dear Sir,

I would be most grateful if you would give a small mention of the West Surrey Computer Club (WSCC) in one of your forthcoming issues. The club has been established some months now but while we have a fair sized membership, we would obviously like to hear from any of your readers who might wish to attend any of our monthly meetings in the Guildford area.

The aim of the club is to promote interest in computers and computing. We have a varied cross-section of members ranging from professional to hobbyists. Our club meetings consist of an informal session (bar facilities available, of course!). This is followed by a more serious session in which interest is focused on a particular subject which will be of interest to as many members as possible.

If you are able to give the club some small mention, I would be happy to receive any replies at the address below. Thank you for your trouble.

Kind regards,
Howard Webb
(Publicity Officer)
101 Park Barn Drive
Park Barn
Guildford
Surrey
GU2 6ER

Dear Sir,

With reference to Mr Dodiha's letter in the March issue of CT concerning the International Phonetic System, I think he is in fact referring to the alphabet used in the larger dictionaries, such as the full sized, multi-volume edition of the 'Oxford', where it is used to give the correct pronunciation of a word after its listing.

It consists of a mixture of Roman (English), Greek and Cyrillic (Russian) characters, each one having a distinct sound and is used to eliminate the ambiguities that exist in the spelling of different languages. For example, any English word that contains a 'C' could be replaced with an 'S' or a 'K', eg Sinderalla & Kat.

In the context of micros, there is the 'GRAND RAPIDS' speech synthesiser language (there is an implementation available for Apple to be used in conjunction with a Texas-type synthesiser chip) which takes a phonetic symbol and

converts it directly to 'voice', and when used in conjunction with special control characters which define pitch, stress and length, complete words or sentences can be written as easily as BASIC and 'spoken' when executed. Watchers of the BBC Horizon programme would have seen it in action a few weeks ago.

I hope this is 'enlightening'.
Yours faithfully,
Mr D J Cranmer
W. Sussex

Dear Sir,

I have been a serious club chess player for several years and so, when I took up the hobby of computing, I inevitably became interested in computer chess. Partly because of the challenge and the fascination of the task and partly due to the dissatisfaction with the chess programs I bought, I would like to write a chess program for my computer.

However, I do not know where to start. I would be grateful if you could recommend some books on the subject, if any exist. The system I have is an Acorn ATOM so any material should be specific to the 6502 processor although general principles would also be helpful.

Yours faithfully,
C Cytera
Bristol

(* Apart from the original Sargon chess program written by Dan and Kathe Spracklen which has been extensively documented in various magazine articles, the only book on the subject that I am aware of is The Chess Computer Book by T D Harding. Published by Pergamon Press at £4.95 (ISBN 0 08 026884 6), it does not cover programming but looks at the various systems available on the market and identifies some of their strengths and weaknesses. If anyone else knows of a good book perhaps they could contact us and we'll pass the information to Mr Cytera. Ed. *)

Dear Sir,

I was very interested to read the article in April's CT about FAD-T, the new US programming language. It would seem, however, that your reviewer has got hold of the old V1.0. I recently had an opportunity to use the new self-compiling V1.1 which includes

many extra commands such as IGNORE (treats all subsequent lines as REM statements), BUG (introduces a random syntax error into the program, useful for debugging training) and LIE X (returns a value which is not X).

A comprehensive range of graphics commands has also been added which include FILL (fills the whole screen with the existing background colour — unfortunately there is only one background colour available in the hardware), and the ingenious GOSUB which sends a little submarine hurtling across the screen, and, of course, RETURN which sends it back again. Very useful for games!

Only one function has been added, TAN(X), which prints X in a tan colour — a useful way of representing overdrawn balances on banking programs. I believe that some banks use this function along with the LIE command above.

I wonder how long it will be before we see programs in this new language. Keep up the good work.

Yours faithfully,
Dave Atherton
Manchester

Dear Sir,

A microcomputer club is now operating in Littlehampton. The club caters for a wide range of micros including the ZX family. We hold meetings on a bi-weekly basis at:

The Wick Amenity Centre,
Wick Farm Road,
Littlehampton,
West Sussex.

For more information, interested parties should contact myself on Littlehampton 7607.

P W H Cherriman
(Secretary)
Littlehampton

Dear Sir,

Over the past four or five months I have noticed an increasing decline in the amount of software presented each month.

February '82 saw the final demise of 'Softspots' which published a wide range of programs each month for a variety of machines.

This decline is due primarily to the increasing number of articles and reviews presented each month.

I must point out that I have nothing against such articles but merely feel that you must achieve some reasonable sense of proportion.

To illustrate my point, in the last three months (March, April, May), only one program listing was given each month whereas in the corresponding three months in the previous year (1981) a total of twenty-seven programs were presented.

My view is echoed by all of my colleagues who read the magazine, and a number have since cancelled their order.

I am not aware of whether or not your readers have declined but if they have not, and those readers I have spoken to are a typical cross-section, then I feel they may well do so.

Yours faithfully,
M T Ward
Aylesbury
Bucks

(* The Softspot feature is by no means as dead as you suppose, indeed there are a number present in this issue. Your comments on the 'decline of software' appears to be based on the lack of small Softspots, one could hardly accuse The Valley of not being software in copious quantity!

What we are trying to do is to increase the overall quality of the software we publish. This involves the production of features containing software ideas and even complete programs, as opposed to the old system where the Softspots were used as an 'ideas' forum containing programs that did not always necessarily work.

If you simply want vast quantities of software, may I draw your attention to our new quarterly publication, Personal Software, the current issue of which contains some 77K of programs for the BBC Micro. Ed. *)

Dear Sir,

I was very pleased to see the series of articles 'Going FORTH' in the January to April issues of your magazine. I believe that Mr Peckett has given a valuable introduction to the language and its use. I do, however, have one or two minor criticisms concerning the use of some words. As Mr Peckett points out, MMS FORTH does have features which are 'non-standard', but some of these have slipped by and may cause

confusion for those wishing to use other versions.

In the vast majority of available implementations of FORTH the word FILL has the following stack action:

FILL (addr count char . . .)
to fill count bytes, starting at 'addr' with the value of 'char'. This is in contrast with the description given for MMS FORTH of:

FILL (char addr count . . .)
Also, the Towers of Hanoi example uses definitions of the words SETUP, UPDATE and MOVE which, in many implementations, would be re-definitions of system words. In disc-based systems the re-definition of UPDATE, which usually controls the writing of screens to disc, may cause unfortunate effects.

I should also like to point out the existence of the FORTH Interest Group UK which exists to promote interest in and the use of FORTH and its related languages. The group holds meetings on the first Thursday of each month at 7pm in the Polytechnic of the South Bank. We also produce a bi-monthly newsletter and have a number of documents for sale to aid the implementation of FORTH on a range of popular micros.

Anyone who requires further information can contact me at Hackney College, Hackney Centre, Dalston Lane, London E8 1LJ or G F Filbey at The Polytechnic of the South Bank, Borough Road, London SE1. An SAE would be appreciated for our reply.

Yours faithfully,
R de Grandis-Harrison
Chairman, FORTH Interest Group UK

Dear Sir,

Like many Acorn ATOM owners I have been following Mr Peckett's series on FORTH with great interest; an implementation already exists for our machine.

Having been told more than once that FORTH programs are both fast and compact I must admit to a twinge of disappointment on reading the final article. The Towers of Hanoi program described is said to occupy 1037 bytes and move a 12-disc stack in 232 seconds. But, the ATOM manual also contains a 'Hanoi' program in BASIC which is also recursive.

Because of the restrictions on the depth of GOSUB nesting, it cannot handle more than 13 discs but moves the 12-disc stack in 250 seconds — almost as fast as the FORTH program — and incorporates the same kind of updated display although without the messages. What's more, the program only occupies 461 bytes and, by shortening the keywords and omitting spaces, can be reduced to under 400 bytes — less than one-third of the size of the FORTH version.

What, then, is all this fuss about? Or maybe it's time a long hard look was taken at the highly Extended Microsoft-type BASIC with which Mr Peckett was making his comparison?

Yours faithfully,
Derek L Haslam
Colne

(*Whilst I take your point, I think it only fair to point out that the Acorn ATOM's implementation of BASIC is much more like a high-level assembler than the Microsoft versions. It doesn't really represent a fair comparison but rather points out some of the strengths of the ATOM as against traditional machines. Ed *)

Dear Sir,

Your NASCOM 2 readers may be interested to know of a method of scanning the keyboard without delay.

By POKEing 4102 (103E Hex) with 223 (DF Hex) and then using INP(98), the value returned will be that of the last key pressed. Because the NASCOM's BASIC is primarily written in 8080 code which does not allow indirection, the following two blocks of code are set up in the workspace RAM:

```
103E DB xx    IN A, (xx)
1040 C9      RET
```

and

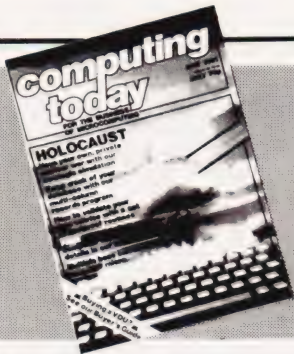
```
1006 D3 xx    OUT (xx), A
1008 C9      RET
```

The BASIC POKEs the port number, xx, and then jumps to the appropriate routine above.

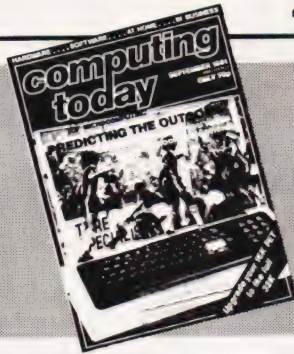
The INCHR routine can be accessed by CALLing the INP(x) function provided the correct argument is provided.

Yours faithfully,
Douglas Rice
Bishop's Stortford

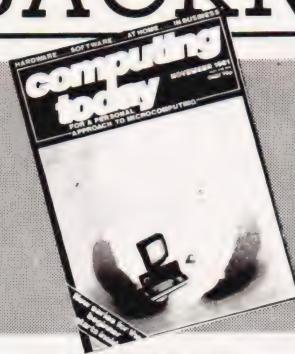
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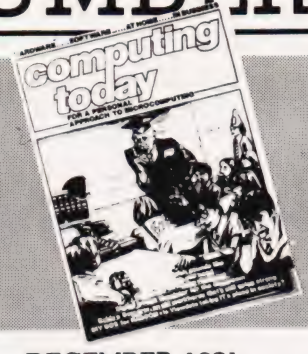
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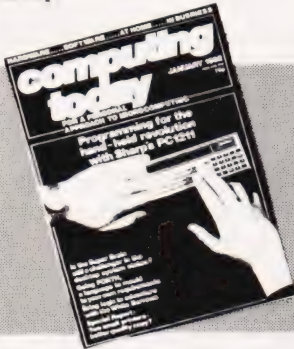
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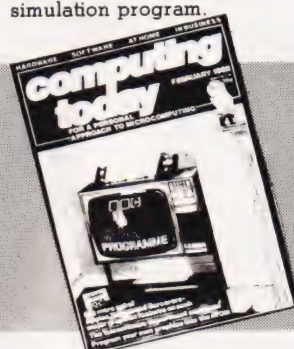
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 Adler's Alphatronic examined, Teletext explained, Speech synthesis board reviewed, New beginners' guide to BASIC.



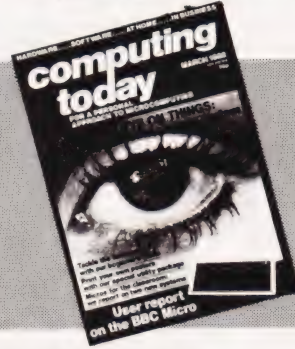
DECEMBER 1981
 Micros in the classroom, Exidy's Sorcerer revisited, DIY DOS for NASCOM, Making sense out of Reverse Polish, Viewdata explained.



JANUARY 1982
 Superbrain revisited, PC 1211 programming, Programming in the FORTH language, Tandy and Sinclair printers reviewed.



FEBRUARY 1982
 The Computer Programme investigated, Graphics for Apple, Sorcerer and Tandy, User programmable graphics for ATOM.



MARCH 1982
 User report on BBC Micro, DIY computerised security system, Terminology translated, Classroom computers reviewed.



APRIL 1982
 The Valley program, TI 99/4 and Tandy Color Computer reviewed, Report on Centronics 737/739 printers, Interfacing series.

Last month's issue is still available as well but has not yet reached the end of its 'shelflife' and is not included for this reason.

If you are thinking of trying to plug some of the holes in your collection of Computing Todays then some fast action is required. Stocks of past issues are running extremely low, we only have the issues shown remaining in stock. If you are missing one of these then now is the time to order it because the

chances are that it won't be in the list next month. All backnumbers cost £1.25 each.

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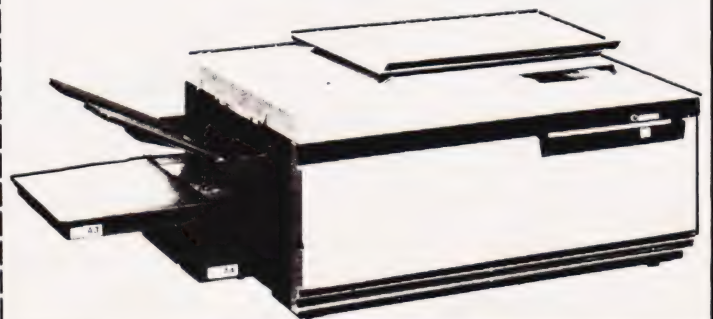
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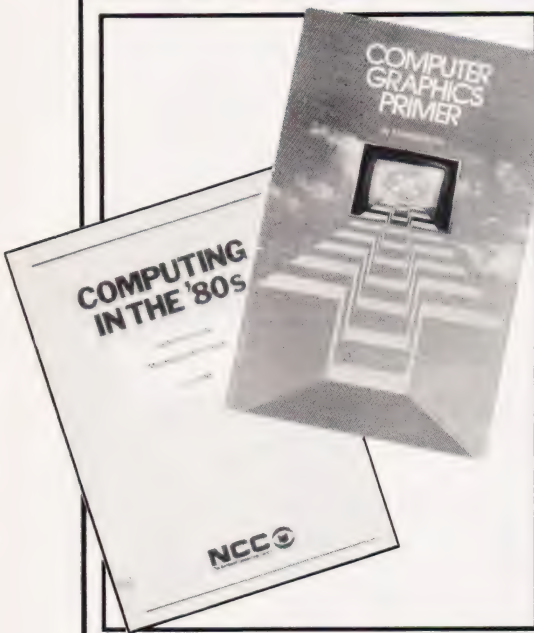
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They say that a picture is worth a thousand words but authors still seem to be producing words about pictures!

understanding of the principles of graphics and the production of graphics displays, a lack of resolution in the display screen need not be particularly restricting; indeed, remarkably detailed images can be constructed using block graphics, given sufficient ingenuity.

The total lack of standardisation in the way that graphics facilities are provided by different micros presents a real dilemma to the author of a book on graphics. The variety of graphics facilities gives an author the choice of writing a book which is specific to one machine thereby correspondingly limiting its appeal, or of writing a general book which touches on no particular machine to any degree. It is also extremely easy to fall between these two stools. I would venture the opinion that a book on graphics should deal with the principles of the subject to some extent in order to achieve a successful treatment; a straightforward collection of techniques may not be sufficient in itself, especially if it does not include the particular technique that one happens to need. We might also agree that a book on graphics should contain many good illustrations and indicate the relationship of computer graphics to graphics in general. Graphics, after all, were produced for many years prior to their production by computers.

There is undoubtedly a need for some good books on graphics, because although the micro manuals usually include one or two programs designed to show the machine's capabilities to good effect, they are usually rather limited in the help that they offer to the user in mastering the full potential of the graphics. The four books under review are among the few available about graphics on micros. One deals specifically with the PET, the second has some general material but its program content relates specifically to the Apple, the next gives general coverage, while the last one deals with principles and is not specific to any micro.

PET Graphics by Nick Hampshire is clearly specific to the PET explaining how to generate displays using the PET's block graphics. Should anyone doubt the quality of the displays that can be produced in

this way, they need only look at the pages preceding each chapter which illustrate many ingenious ways of using the full dot resolution of the screen. On a 40-column PET, there are 25 screen lines and an 8 x 8 dot matrix for each character position; the dot resolution is consequently 320 x 200. The full dot resolution can be used in a display because there are, for example, eight different horizontal bar graphics characters, one for each row of the character dot matrix. Hampshire gives many techniques for using these characters, and other similar ones, for generating 'pseudo high-resolution' displays; having mastered these, the PET user need envy the graphics facilities of no other micro. I admit to being keen on block graphics and to being intrigued by the devious methods which are sometimes needed to manipulate them, but the quality of Hampshire's displays speak for themselves.

The book starts from absolute basics by explaining how displays can be produced using first PRINT and then POKE commands. While programs written in BASIC are presented throughout the book, attention quickly moves to machine code programs. In fact, the machine code programs are organised into a graphics package designed so that it can be loaded into the top of the memory. In an innovation that I particularly admire, the machine code package is available on disc in a fully tested form. There is consequently no need to spend a lot of time typing in programs only to suffer the frustrations caused by the inevitable errors. The package itself includes routines for drawing horizontal bars, vertical bars and borders around a particular screen area, as well as for causing a particular screen area to be displayed in reverse field.

There are chapters on screen and block scrolling, double density plotting and displaying and moving large characters. I am sure that any PET user interested in graphics would find this book indispensable. After mastering its contents, the reader should have learnt as much about the PET and machine code programming as he would have learnt about graphics.

The graphics facilities of micros have always been among their most attractive features. The quality of graphics on micros is still improving, especially with the BBC microcomputer having an amazing resolution of 640 x 256 in its highest graphics mode and the secrets of the remarkable Atari colour graphics beginning to emerge. These kinds of facilities have endless applications in improving the attractiveness and quality of games; in making realistic simulations possible; and in the graphic presentation of information for business and many other purposes. In fact, the graphics hardware available with micros is rapidly approaching the stage at which it could display many of the graphic images shown in BBC television's recent Horizon programme on the latest research and development activities in computer graphics.

Of course, it takes a good deal of memory to represent a high-resolution display, and this can make micros which possess them relatively expensive. It can also mean that much of the available memory is used by the graphics, leaving rather less than one might wish for program storage. For these reasons (although the highest resolution displays are almost always the most attractive) when a program is generating graphic displays, there is, on many machines, a trade-off between the amount of memory needed by the program and the graphics. This can necessitate the use of lower resolution modes. Some micros, such as the PET, only possess block graphics. However, with a good

BOOK PAGE

My only real quibbles, and they are minor, are that in such a good book the quality of the English and the spelling are in places so poor as to be distracting, and the table showing the block graphics characters is nowhere near the quality of the ones published in *Computing Today*.

Computer Graphics Primer by Mitchell Waite contains three chapters and two short appendices. The first chapter is a truly dire general introduction. It begins: 'Rod leaned slightly forward, his eyes intently fixed on the screen before him.' Enough said, I should think. I would recommend that nobody waste any time reading this chapter. Do, however, look at the pictures as they include some fine examples, in colour, of what computer graphics can achieve. The second chapter deals mainly with the hardware techniques used by computer graphics equipment. Not all of the material is relevant to graphics on micros, but the material is good and is quite well presented. The third chapter, called 'Graphics programming', deals with programming the Apple II in high-resolution graphics mode. It covers general plotting, shape tables, transformations and animation. Some of the material covers the same ground as Apple's Applesoft manual, but the book does complement and extend the treatment given in the manual. To me, though, this book is a pretty expensive way of obtaining a minor extension of the Apple manual which, as it happens, is rather good.

Graphics on Microcomputers by J E Lane is in the NCC's *Computing in '80's* series. It claims to review 'the current trends in graphics on low-cost micro-processor-based systems' and to provide 'information on a number of commercially available systems'. Well it does — but it contains very little that could not be found in an 18-month old copy of *Computing Today*. The book presents the specifications of the PET, Apple and Acorn Atom, among others, but it makes no mention of the BBC Microcomputer, the Atari machines or of Hewlett-Packard's micro-computer-based graphics equipment. A look at 'picture building' techniques is also promised, and this would be interesting and valuable. However, what is presented is a copy of two magazine articles which have been re-written sufficiently to avoid violating the copyrights. (To declare an interest,

one of these articles is by the reviewer.) I found this book very disappointing. To pay the asking price for 57 typed A4 pages reduced to A5 seems expensive, but given the outdated and un-original contents it is exorbitant!

A Practical Introduction to Computer Graphics by I O Angell is not aimed at micro users at all, really. Its programs are written in FORTRAN: the graphics commands are based on the Calcomp library, which is a library of FORTRAN subroutines providing graphics facilities originally intended for use with Calcomp graphic plotters. If this does not sound promising, do not despair. The programs presented in the book can all be readily translated to BASIC, and the graphics routines either have familiar names and purposes or can be readily related to the commands available for graphics on any micro.

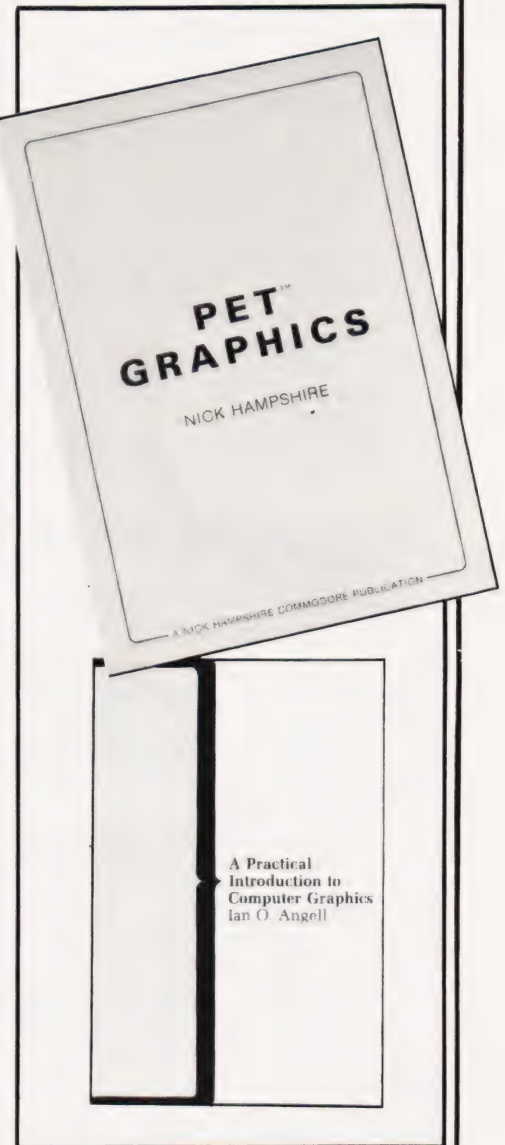
Besides providing a practical introduction to graphics (as promised in its title) the book also gives the best introduction to the underlying principles of computer graphics that I have read. It deals with two-dimensional geometry in a painless fashion, followed by two-dimensional transformation. Clipping and covering are also treated — an image is clipped so that only the parts of it within the plotting area are shown, while covering (the reverse of clipping) permits areas of the image to be suppressed.

The book then moves on to deal with three-dimensional objects, showing how to model, transform and generate perspective views of them. This leads on to a treatment of some rather advanced topics including the removal of hidden lines and surfaces in three-dimensional scenes and animation. Throughout the book there are many superb examples of computer-generated images.

After reading this book, it should be possible for the reader to develop his own graphics software for any of a wide variety of applications. Many example programs are given, but the important thing is that all the underlying principles are presented and are clearly explained. I am confident that there are no real problems in converting the programs in the book to BASIC programs using the graphics commands of any of the micros having high-resolution displays, and I thoroughly recommend the book to anyone with an interest in graphics.

It is interesting to reflect that

both the successful books, by Hampshire and Angell, contain good illustrations. Finally, the only book which discusses the design of graphic images prior to their actual production is Hampshire's.



The books included in this month's selection were:

PET Graphics by Nick Hampshire, published by Commodore Business Machines (1981), £10.

Computer Graphics Primer by Mitchell Waite, published by Sams (1979), £10.45.

Graphics on Microcomputers, by J E Lane, published by NCC (1981), £4.

A Practical Introduction to Computer Graphics, by I O Angell, published by Macmillan (1981), £5.50.



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CT STANDARDS

Our regular page explaining the meaning of the various symbols we use to make programs portable.

It has been very encouraging to see the number of programs submitted using our standard codes for graphics and other non-printable characters. However, it has also become increasingly clear that some of our readers haven't heard of them and this page is intended to set them out once again.

All standards tend to be irksome to adhere to but the ones laid out here are fairly simple and tend to make software easier to maintain by the programmer and simpler to understand for others.

Controlling That Cursor

Our original standards have now grown with the times. Machines such as the Commodore VIC which have a dual Shift capability can now be incorporated, as can those systems which use Control key functions.

The recently introduced BBC system of pre-programmed function keys which, we are glad to say, can also be handled by our original coding system. It's nice to see just how well adapted the original standards have become over the last two years! (Indeed, a whole series of books is using them as its *de-facto* standard.) The standards for the cursor controls are given in Fig. 1.

[CLS]	CLear Screen
[HOM]	HOme cursor
[CL]	Cursor Left
[CR]	Cursor Right
[CU]	Cursor Up
[CD]	Cursor Down
[REV]	REVerse video on
[OFF]	Turn it OFF
[SPC]	SPaCe
[CTL]	ConTRol key
[fn]	Function key (BBC)
[G<]	Graphic left (VIC/MZ-80A)
[G>]	Graphic right (VIC/MZ-80A)

Fig. 1. Our extended set of cursor control standards includes four new functions.

Don't forget, you may have to look up and alter the values used elsewhere in the program.

The Graphic Solution

It soon became obvious that the techniques applied to the confusing cursor controls could also be applied to the graphics symbols. The following standard is now in general use in programs published in Computing Today.

If a graphics character or characters are to be displayed in a listing (as opposed to POKE codes or CHR\$() codes) then they are indicated by the method shown in Fig. 2.

Several people have asked what the relationship between the POKE value for a character and that of its shifted graphic might be. In general the shifted version of any character will be 64 greater than the value of that character. This applies to both PET and MZ-80K systems in all cases.

This can be taken further to include machines which use a pixel graphics set rather than pre-programmed PET-style characters and the series of codes for these is given in Fig. 3. As is nearly always the case there is one machine to which the standard

Making REMarks

Many people scorn the use of REMs within programs but, during the development at least, they are extremely useful. One of the documentation methods that we use is to keep our back-up copy of our programs on a 300 Baud CUTS tape with all the REMs in place: the working copy, be it on tape or disc, is REMless in order to save space.

It is also good programming 'manners' to give your REMs odd line numbers:

```
3999 REM ** CRASH PROOF INPUT
```

```
4000 INPUT "THE NUMBER OF ENTRIES ";AS
```

A remarkable number of submitted programs have jumps that go not to the relevant point in the program, but to the REM statement. This can cause severe problems when re-numbering after removing the REMs.

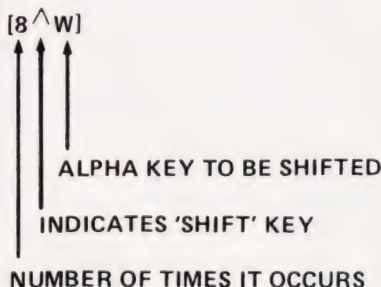


Fig. 2. The way we indicate block graphics on machines like the PET and Sharp. The VIC system of Shift Left and Shift Right is shown in Fig. 1.

1	2
4	8
16	32
64	128

Fig. 4. To convert a Tangerine pixel code into its blocks, simply decode the number into its binary or Hex value and fill in the relevant squares.

To indicate more than one of the above, an optional number can be placed within the brackets; [4CL], etc.

The use of square brackets has raised one or two queries. The reason for this choice is that *most* of the common microcomputer BASICs don't use them for specific functions. In fact, at least one machine provides an added bonus by returning a Syntax Error if they are found, a useful check in case you type them in by mistake.

The code [SPC] was added to the list of cursor control codes to get over the problem of indicating just how many spaces are contained in the gap in the printout. The other common variant of the code for spaces is used by the ZX people. Their choice was ^ and this crops up in the various newsletters they publish.

The code [RVS] has caused a few headaches. This is really specific to the PET where the character set can be displayed in reversed video. On machines which don't have this facility you should either find a character in the set which is the reversed image of the one you want and use that or simply ignore it and use anything else you fancy!

shown in Fig. 3 does not apply — Tangerine's Microtan/Micron. This machine uses a four by two cell structure for its pixel graphics instead of the Prestel/Teletext three by two cell. The method for calculating the value to assign to 'P' is shown in Fig. 4, and is fortunately nice and simple.

□□	■□	□■	■■	□□	■□	□■	■■	□□	■□	□■	■■	□□	■□	□■	■■	□□	■□	□■	■■	□□	■□	□■	■■	□□	■□	□■	■■	□□	■□	□■	■■
[P0]	[P1]	[P2]	[P3]	[P4]	[P5]	[P6]	[P7]	[P8]	[P9]	[P10]	[P11]	[P12]	[P13]	[P14]	[P15]																
□□	■□	□■	■■	□□	■□	□■	■■	□□	■□	□■	■■	□□	■□	□■	■■	□□	■□	□■	■■	□□	■□	□■	■■	□□	■□	□■	■■	□□	■□	□■	■■
[P16]	[P17]	[P18]	[P19]	[P20]	[P21]	[P22]	[P23]	[P24]	[P25]	[P26]	[P27]	[P28]	[P29]	[P30]	[P31]																
□□	■□	□■	■■	□□	■□	□■	■■	□□	■□	□■	■■	□□	■□	□■	■■	□□	■□	□■	■■	□□	■□	□■	■■	□□	■□	□■	■■	□□	■□	□■	■■
[P32]	[P33]	[P34]	[P35]	[P36]	[P37]	[P38]	[P39]	[P40]	[P41]	[P42]	[P43]	[P44]	[P45]	[P46]	[P47]																
□□	■□	□■	■■	□□	■□	□■	■■	□□	■□	□■	■■	□□	■□	□■	■■	□□	■□	□■	■■	□□	■□	□■	■■	□□	■□	□■	■■	□□	■□	□■	■■
[P48]	[P49]	[P50]	[P51]	[P52]	[P53]	[P54]	[P55]	[P56]	[P57]	[P58]	[P59]	[P60]	[P61]	[P62]	[P63]																

Fig. 3. The standard pixel codes; they will work on most computers which employ this technique as well as for Teletext and Prestel.

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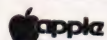
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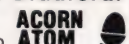
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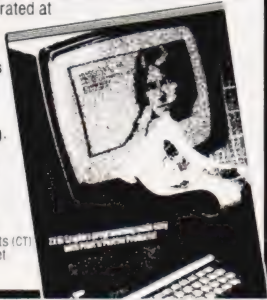
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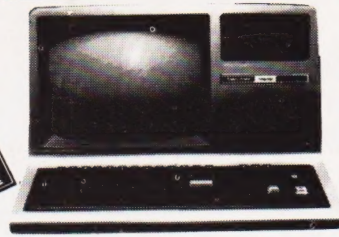
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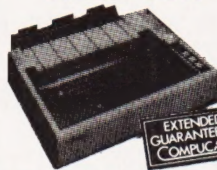
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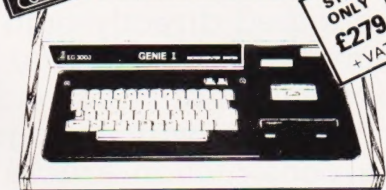
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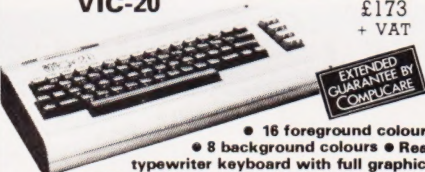
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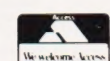
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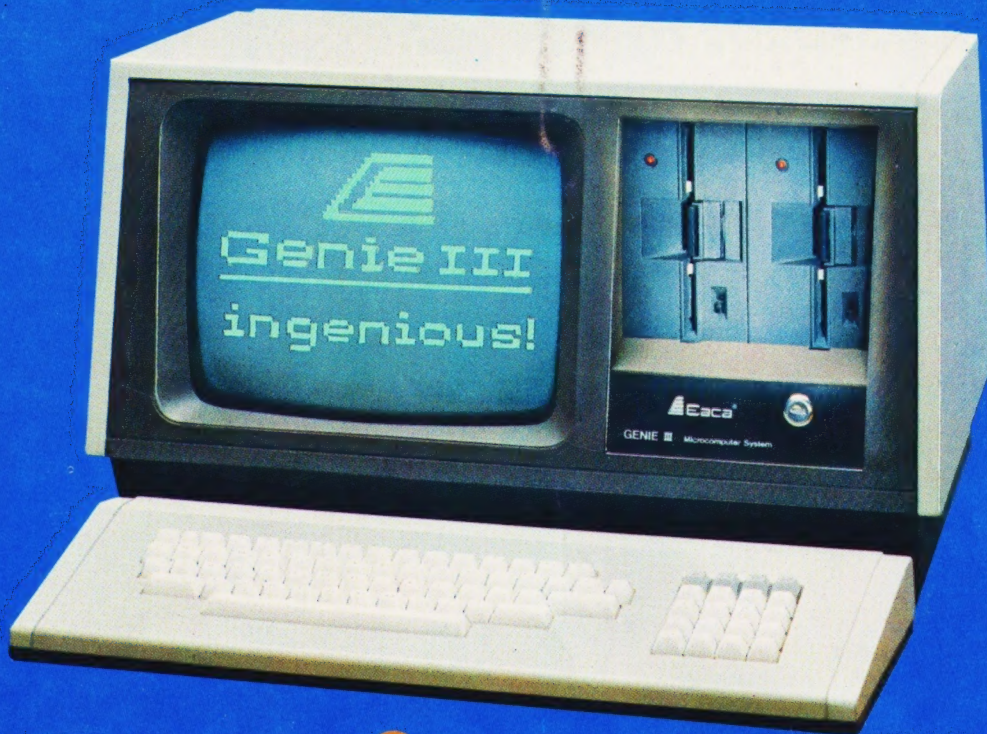
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